HEALTH ASPECTS OF PESTICIDES

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U.S. ENVIRONMENTAL PROTECTION AGENCY

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OFFICE OF PESTICIDE PROGRAMS

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HEALTH ASPECTS OF PESTICIDES ABSTRACT BULLETIN is a monthly publication of the Technical Services Division of the Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides on humans. The publication represents a monthly review of more than 1150 domestic and foreign journals. Subjects and authors of abstracted articles are cross-referenced in an annual index issue. Reprint requests should be directed to the author of the complete article.

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CONTENTS

Vol. 6 July 1973 No. 7

Page

General 343

Monitoring and Residues 347

Epidemiology, Prevention and Treatment 359

Toxicology and Pharmacology 364

Analysis 394

73-1523. Matthews, L. (Author address not given). **Pesticides.** *Agrichem. Age 15(10): 18; 1972.* (4 references)

A paper written by a high school student defends the prudent use of pesticides, especially DDT. Absence of gross effects on human and animal health, questionable mutagenicity data, increased food production and better disease control, and sanction by the WHO and various governmental agencies seem to justify using DDT until safer compounds are developed. Pesticides should be used sagaciously; governmental regulation could prevent abuse and hazards resulting from discontinuation.

73-1524. Anonymous. **We're not "slamming the door" on pesticides.** *Amer. Veg. Grow. 20(12): 16-18; 1972.*

During an interview William Ruckelshaus elucidated the position of the Environmental Protection Agency (EPA) regarding chemical pesticides. The EPA is trying to improve the availability of pesticides according to the demand of the environment while increasing the benefits and minimizing the hazards. Although not considered an imminent hazard, DDT was banned because of evidence of possible long term effects and potential hazards; increased resistance to DDT necessitated heavy applications which could impair the environment. In all of the hearings concerning pesticides an effort is made to hear both sides, and two-thirds of the testimony on DDT came from its proponents. The increase in fee petitions for tolerances was not intended to discourage pesticide applications, but simply to reflect the rising cost of increasingly complex processes. To prevent the movement against pesticides from snowballing farmers should present their opinions at the hearings.

73-1525. Van den Bosch, R. (Div. Biol., Univ. of California, Berkeley, CA). **Biological control of insects.** *Annu. Rev. Ecol. Syst. 2: 45-66; 1971.* (101 references)

Critical publications are reviewed concerning the present state of biological control of insects with emphasis on developments since 1960. Usually, the insect's biology is researched and its natural enemies introduced into an infested area. When fully effective, permanent pest suppression results; only pests which are not native, about one third of those in the U. S., can be controlled by this method. Unfortunately, synthetic organic insecticides have reduced the number of natural pest enemies. Since 1960, 14 substantially successful programs have been reported. New methods include multiple species introduction, pooling samples from different places to develop a genetically suited colony, using natural enemies adapted to the climate, and using entomophagous arthropods against insects without natural enemies or competitors. Since recent studies have shown that importation of hyperparasites of any kind should be avoided, naturally occurring biological control has received increasing attention. Increased finances, competent personnel, and adequate facilities could improve the success of biological control programs.

73-1526. Georghiou, G. P. (Dept. of Entomol., Univ. California, Riverside, CA). **The evolution of resistance to pesticides.** *Annu. Rev. Ecol. Syst. 3: 133-168; 1972.* (209 references)

Studies concerning the interface of behavior and ecology and their relationship to known biological correlates of resistance are reviewed. Natural enemies of pests have a much lower capacity for developing resistance than the pest because they are dependent on host density. Biochemical parameters responsible for resistance include altered detoxication or activation mechanisms, induction of enzymes, reduced binding capacity, and reduced sensitivity of target enzymes. Reduced penetration, reduced nerve sensitivity, and alterations in reproductive potential, vigor or length of developmental period seem to be involved in resistance. Insecticide exposure may also cause selection of behavior resulting in "resistance." Almost every insect species will develop some tolerance to an insecticide with the presence of resistance genes and sufficient selection pressure. Cross resistance and multiple resistance often develop. Under laboratory conditions and often happening in the field, resistance regresses when insecticide pressure is removed. Information on the dynamic changes in susceptibility occurring in predator-prey associations or in food chains is needed.

73-1527. Allan, G. G.; Chopra, C. S.; Friedhoff, J. F.; Gara, R. I.; Maggi, M. W.; Neogi, A. N.; Roberts, S. C.; Wilkins, R. M. (College Forest Resources, Univ. Washington, Seattle, WA 98195). **Pesticides, pollution and polymers.** *Chem. Technol. 3(3): 171-178; 1973.* (112 references)

Pesticides embedded or encapsulated in polymers can be used for the controlled release of many chemicals, especially systemic insecticides which are absorbed by root systems and translocated to the leaves of the plant. The design of these systems is determined by the chemical structures of the pesticide (determined by predictable host-insect relationships) and the polymer (infinitely variable). Covalent bonding of a pesticide to a polymer can also be used, and release is achieved through degradation in the environment. Compared to free pesticides, the combinations provide an extended period of activity using equivalent amounts or the same protection using greatly reduced amounts. Hazards from highly toxic materials are reduced with the non-toxic polymer combinations and secondary poisoning of parasites is unlikely. Leaching of pesticides into groundwater and waterways should be eliminated. The nation's solid waste could be disposed of using biodegradable tannery, cannery, and agricultural residues as polymers, when applicable, for controlled release systems.

73-1528. Van den Bosch, R. (Div. of Biol. Control, Univ. of California, Berkeley, CA). **The cost of poisons.** *Environment 14(7): 18-22, 27-31; 1972.*

Attempts to control cotton pests have often failed due to nonselectivity of insecticides which results in destruction of pest predators as well as the pests. If no insecticides were used, estimated losses of cotton crops in the San Joaquin valley would amount to $15 million. However, this is less than the cost of the chemicals currently used, and environmental damage from insecticides would be eliminated. Biological and integrated control measures have greatly increased both the effectiveness and the safety of insect-control programs in some test situations. An integrated-control program involving reduced amounts of insecticides saved $15 per acre of cotton in insect-control costs. Systematic application of available biological control methods could permit even further reductions.

73-1529. Chapman, D. (Dept. Agr. Econ., Cornell Univ., Ithaca, NY). **An end to chemical farming?** *Environment 15(2): 12-17; 1973.* (8 references)

The economic results of restricting farm chemicals may not necessarily be the predicted lower average income for farmers and higher food prices. The average net farm income would probably rise although those farms which presently depend most heavily on pesticides could experience a decline in profits. Higher production cost for farmers may result, but with only a minimal increase in cost to the consumer; the percentage increase in farm cost is only a fraction of the average food dollar. More farm employment could result from a decrease in yields/acre. A 1% increase in cropland over the nation could result in a 6.5% decrease in insecticides required for the same output. Quality of products produced without chemicals would be better in some instances (cereals) and worse in others (fresh produce).

73-1530. Pimentel, D. (Author address not given). **Realities of a pesticide ban.** *Environment 15(2): 18-20, 25; 1973.*

About one-half of the billion pounds of pesticides used annually in the U. S. are used in agriculture; 12% is applied to cropland as insecticides, 27% as herbicides, and 1.3% as fungicides. Overall crop losses due to insects have increased despite the use of insecticides, but some important loss reductions have been made. If no pesticides were used, a loss of $2.1 billion more than the $12 billion incurred with pesticides (1951-1960) is estimated. The 7.1% increased loss would result in a 28.4% increase in farm product value. Pesticides are valuable pest-management tools but have been substituted for environmental controls. One method of reducing pesticide use is to utilize soil bank acres to plant more crops. Combined savings in pesticide and farm subsidies could offset some of the anticipated loss. Planting major crops in geographic areas where pests are less numerous, using resistant strains, returning to crop rotation, proper timing of pesticide applications, development of bio-environmental controls, and educating the public with safety rather than appearance of produce are alternatives.

73-1531. Medved, L. I. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastic Materials, Kiev, USSR). **Pestizide und Hygiene–Probleme. [Pesticides and problems of hygiene.]** *Ernaehrungsforschung 16(4): 473-477; 1971.* (German)

Pesticide-related hygienic problems are reviewed. Pesticides, especially when applied from aircraft, contaminate the air; leaching from the soil by groundwater and washing into surface water are also possible. Pesticides which are highly cumulative, have retarded and allergenic action, and are persistent should not be used in agriculture. Toxicological studies of pesticides on animals are concerned with the relation of oral to cutaneous toxicity, embryotoxicity, carcinogenicity, cumulative, mutagenic, allergenic properties, solubility, and volatility. Tissues from hares captured in areas with extensive sugar beet growing and intense organochlorine pesticide use contained up to 10 ppm of DDT; hares from areas without sugar beet production had no DDT. The fecundity of DDT-contaminated hares was about one fifth the control level.

73-1532. Koeman, J. H. (Inst. Vet. Pharmacol. Toxicol., Univ. Utrecht, Utrecht, The Netherlands). **Toxicological implications of pesticides in surface waters.** *Foed. Eur. Gewaesserschutz. Informationsbl. 18: 40-44; 1972.* (43 references)

Organochlorines in water, which have been studied extensively, but not methodically, reach greater concentrations in aquatic organisms than in humans drinking the water; solid particles to which DDT adheres are filtered out in treatment facilities. Less work has been done on the organophosphates, carbamates, and most of the herbicides regarding environmental distribution and rates of transfer between different compartments. Straight extrapolation of metabolic data is not always possible after toxicity tests since fish often concentrate compounds to a greater extent than other animals. In tests diuron has been concentrated 20 fold in fish and not at all in rats and dogs. High susceptibility to organochlorines has been observed in algae, fish, and fish-eating organisms and is increased by the sudden release of pesticides stored in adipose tissues under stress. Effects of pesticides on water organisms are influenced by the number of molecules reaching receptors and the reactivity of the molecules within the organism.

73-1533. Anonymous. **Control of poisonous substances: pesticides–Argentina.** *Int. Digest Health Legis. 23(3): 434-435; 1972.*

Two changes were made in Argentinian laws regarding the control of pesticides. Law No. 18073 prohibited the use of certain substances in the treatment of natural and sown pastures and the treatment of animals of the bovine, ovine, caprine, porcine, and equine species; in 1970 it was amended by providing that pesticides may not exceed prescribed levels in the products of agriculture and animal husbandry listed. Decree No. 2678 now prohibits transport and storage of all pesticides with foodstuffs, beverages, medicaments, etc.; repackaging or sale in bulk in non-authorized establishments; and storage, transport, and sale in incorrectly labelled containers. All persons regularly engaged in the production, distribution, or sale of pesticides are required to furnish information demanded by the enforcement authority concerning consignments or sales.

73-1534. Anonymous. **Control of poisonous substances: pesticides–Belgium.** *Int. Digest Health Legis. 23(3): 458; 1972.*

The Belgian Law of April 2, 1971, empowers the Crown to prescribe, prohibit, or regulate the use of pesticides, plant protection products, and other methods used for controlling plant pests. The Crown Order of 31 May, 1958, was amended to prohibit marketing, acquiring, displaying, offering, holding, preparing, transporting, selling, supplying against payment or free of charge, importing, or employing phytopharmaceutical products not previously approved by the Minister of Agriculture. The order requires that the products be employed only under conditions set down in the application or pursuant document, and that all precautions necessary are taken to avoid injury to persons or useful animals and damage to neighboring crops and the property of others.

73-1535. Anonymous. **Control of poisonous substances: restrictions on paraquat–Ireland.** *Int. Digest Health Legis. 23(3): 545; 1972.*

Regulations added to the Irish Poisons Act, 1961, prescribe that paraquat and its salts in all but solid preparations containing not more than 5% active ingredient must be distributed, supplied, sold or offered, or kept for sale only by authorized persons. These include the manufacturer and wholesaler of the poison, a registered pharmaceutical chemist or registered dispensing chemist and druggist, a registered druggist, a licensed member of Apothecaries Hall, and a person temporarily licensed under the Poisons and Pharmacy Act. The pesticide must be secured in the sealed container supplied by the manufacturer and the word "poison" clearly indicated. A warning that the contents should be kept out of the reach of children, not be ingested, and not be repacked from the container is required. That the container should be destroyed when empty must also be legibly written on the outside packaging.

73-1536. Tanabe, H. (National Inst. of Hygienic Sciences, Japan.) **[Various problems in the food-hygienic chemistry.]** *Iryo (Med. Treat.) 25(9): 643-645; 1971.* (Japanese)

Acute poisoning by pesticides which occurred frequently during the early years of pesticide use has been greatly alleviated by active preventive measures and the awareness of pesticide users. Awareness concerning the toxicity of pesticide residues in agricultural produce has grown. The maximum allowable residue standards for 13 produce and 8 kinds of pesticides are most strict in Japan. The standards were established based on animal toxicity experiments and investigation of actual residue data. One fact uncovered is that the toxicity of the degenerated pesticide toxoid is often much greater than that of the original chemical. The transformation is caused by atmospheric oxidation, photosynthesis, photochemical reaction, and other extremely complex chains of reactions in addition to the metabolism in the plants. This problem will require solving in the future.

73-1537. Kiritani, K.; Yushima, T.; Kanazawa, J. (Min. Forestry, Agr. Tech. Res. Inst., Japan). **[Pollution of the ecosystem by pesticides. I. Transition of biota in the agro-ecosystem.]** *Kagaku (Science) 41(6): 306-314; 1971.* (23 references) (Japanese)

The appearance of organosynthetic pesticides and the growing resistance and immunity among insects, the general effects of pesticides on agro-ecosystems, the decimation of insect species and the loss of natural balances, and the characteristics of main insecticides are discussed. The production of total pesticides in Japan increased from about 3 billion yen in 1949 to 40 billion yen in 1968. To evince the increase in use of more pesticides over the years, the chemicals used for apples in Iwate Prefecture from 1953 to 1966 are given. Only one organophosphate (Polydol) was used in 1953; 18 new products were added by 1966, gradually eliminating the target insects. Diminishing of the earth's biomass and loss of natural balance is anticipated.

73-1538. Gerhold, M. (Arbeitskreis "Umweltschutz," ICEF Consulting Gesellschaft fuer industrielle Beratung und Entwicklung mbH, Graz, Austria.) **Bestandsaufnahme und Basiskonzept fuer efficienten Umweltschutz. [Assessment of status and basic concepts for efficient environmental protection.]** *Mitt. Chem. Forschungsinst. Wirt. Oesterr. Oesterr. Kunststoffinst. 26(5): 201-212; 1972.* (51 references) (German)1

General problems and perspectives in environmental protection are outlined. Highly persistent DDT and other organochlorine pesticides, found even in the most remote parts of the world, accumulate in aquatic organisms and eventually translocate to higher organisms and man. The DDT residue level in fish would not decrease before 1995 even if use of DDT had been phased out during 1970. Since the bans imposed on

several pesticides have little if any ecological effect, new products and application techniques with minimal side effects on the environment should be developed.

73-1539. Rogers, A. J. (West Florida Arthropod Res. Lab., Panama City, FL). **Eagles, affluence and pesticides.** *Mosquito News 32(2): 151-157; 1972.* (17 references)

Apart from the obvious usefulness in controlling malaria and other diseases, pesticides are necessary to maintain our food supply, prevent open areas from being used for food production, and relieve the pressure on wild animals as food. The antipesticide lobby present pesticides as major environmental pollutants which cause the decline of several birds of prey. Evidence of decline in eagle populations appeared long before DDT was in use. Many other factors have been apparent since DDT's introduction and were probably responsible for much of the mortality among eagles. Predator control through shooting and poisoning has killed at least 120,645 of these birds. Reproductive failures have probably resulted more frequently from human intrusion than pesticide intake.

73-1540. Henschler, D. (Author address not given). **Veraenderungen der Umwelt — toxikologische Probleme. [Changes in the environment— toxicologic problems.]** *Naturwiss. Rundsch. 26(2): 74; 1973.* (German)

General toxicological problems of environmental chemicals are surveyed. Modern toxicology is based on the evaluation of the long-term effect of small doses or concentrations of potentially toxic substances through chronic animal tests or possibly by analysis of epidemiological data. Animal experiments are based on the assumption that a dose-effect relationship and a no-effect level can be found. Meaningful animal tests require that the action profiles of the test substance be similar in animals and humans. Organ distribution of test substances usually differs in various species. Decisions to ban specific toxic substances should be based on observed intensity, duration, and frequency of impact rather than on evidence of toxic effects alone.

73-1541. Chipman, M.; and Runeckles, V. C.; and Rose, H.; Rose, S. (Dept. Neurol., State Univ. N.Y., Upstate Med. Cent., Syracuse, NY 13210; and Dept. Plant Sci., Univ. Brit. Columbia, Vancouver, 8, Canada; and Dept. Social Sci. and Admin., London School of Econ., London, WC2A 2AE, England). **Herbicides in Vietnam.** *Science 179(4078): 1075; 1973.* (2 references)

Letters-to-the-Editor concerning an article entitled "Chemical Spraying as Reported by Refugees from S. Vietnam" (see abstract 72-2370) question the validity of data obtained by verbal report and also the reference in its abstract to the occurrence of monstrous births in humans. The original authors reply that problems of faulty recall and wishing to please are routine in sociological questionnaires and appropriate precautions were taken. No attempt was made to define described symptoms neurologically. In the text it was stated that 5% of those interviewed referred to abortions or monstrous births and 4% spontaneously referred to human abortions as a sequel to spraying. The abstract summarized these statements.

73-1542. Shapley, D. (Author address not given). **Herbicides: Agent Orange stockpile may go to the South Americans.** *Science 180 (4081): 43-45; 1973.*

As a result of an idea formulated by two American businessmen, the U.S. government is considering the sale of 2,338,900 surplus gallons of Agent Orange (2,4-D and 2,4,5-T) to South American governments. The material, which has a very high dioxin content, was withdrawn from S. Vietnam after a number of reports of stillbirths and defective fetuses in sprayed areas. Dioxin is quite persistent and highly teratogenic, and the expected burning of brush containing the mixture would result in the release of more dioxin into the environment. There are indications that 2,4-D and 2,4,5-T are also teratogenic. The difficulty of achieving proper use of the agent in agriculture and the possibility of its use for paramilitary destruction of crops etc. add to the concern over this transaction. The Air Force is prepared to sell the surplus if the countries want it and are aware of the dioxin content. The State Department will not sanction the sale unless the Environmental Protection Agency rules favorably on the application for its domestic use.

73-1543. Smetana, M.; Stankovsky, I. (Statna Veterinarna Sprava MPVz SSR, Bratislava, Czechoslovakia). **Niektore aspekty hygieny ziskavania a osetravania mlieka v polnohospodarskych zavodoch. [Some hygienic aspects of milk production and processing in agricultural areas.]** *Vet. Casopis 5(14): 135-141; 1972.* (Slovak)

Hygienic aspects of milk production in Slovakia in 1969-1971 are reviewed. Recommended maximum permissible levels of DDT and BHC in milk and milk products are 0.027 mg/kg and 0.029 mg/kg respectively by December 1975, and 0.015 mg/kg and 0.015 mg/kg after January 1976. Corresponding maximum permissible levels for DDT and BHC in butter are 0.926 and 0.994 mg/kg up to December, 1975, and 0.528 and 0.726 mg/kg respectively after January 1976. For other milk products the level for both DDT and BHC is 1000 mg/kg till December 1975 and from January 1976 on 0.570 mg/kg and 0.730 mg/kg respectively. Improved sanitation and insect control in Czechoslovakian milk production are advised.

73-1544. Akesson, N. B.; Yates, W. E.; Wilce, S. E. (Agr. Eng. Dept., Univ. California, Davis, CA). **Needed: better drift control. Pesticide drift control results summarized for 1972.** *Agrichem. Age 15(12): 9-12; 1972.*

Drift control during pesticide application can only be reduced by the use of large spray drop producing equipment and careful consideration of the weather, time, and place. With the low turbulence nozzles (LTN) numbers of drops below 500 μm are less than with other nozzles and recoveries can be > 99%. With phenoxy herbicides and other highly active compounds, however, even one-fourth percent loss could damage an adjacent susceptible crop. Most of the spray additives on the market which produce large drops do not eliminate small drops, and a 1% to 2% drift occurs. Farmers should insist on seeing unbiased research data in support of any claim for drift control rather than risking an expensive damage suit. Extreme care in applying chemicals is necessary to prevent valuable pesticides from being withdrawn from the market while more satisfactory methods of pest control are being developed.

73-1545. Davies, J. E.; Edmundson, W. F.; Raffonelli, A.; Cassady, J. C.; Morgade, C. (Community Studies—Dade County, Florida State Div. Health, Miami, FL 33125). **The role of social class in human pesticide pollution.** *Amer. J. Epidemiol. 96(5): 334-341; 1972.* (7 references)

A survey of 800 residents of Dade County, Florida, revealed differences in serum levels of DDT and its metabolites related to age, social class and race. The effect of age on pesticide residue was much stronger in the first two decades of life, corresponding to the years during which DDT has been used. For this reason study of the socioeconomic variables was restricted to people over 20 years of age. The Hollingshead and other socioeconomic classifications did not wholly account for differences in DDT residues observed between races. Serum levels of DDT and DDE were significantly lower in the more affluent social classes than in the less affluent classes in both races, but within the classes blacks still had higher residues. Levels of dieldrin were higher in poor white persons than in affluent ones, but the relationship did not hold for blacks. No sex differences were observed in serum levels of total DDT or dieldrin. The correlation of high pesticide residues with increasing poverty and overcrowding in a semitropical climate suggests that increased domestic use of insecticides may be a significant nondietary source; it may be necessary to monitor man as well as his food to measure incidental exposure.

73-1546. Cramer, J. (Stone & Webster Engineering Corp., Boston, MA). **Model of the circulation of DDT on earth.** *Atmos. Environ. 7(3): 241-256; 1973.* (50 references)

A model was established for the global transport and accumulation of DDT based on a low mean residence time of the chemical in the air and low rate of transfer of DDT from land to air. The importance of the food chain was deemphasized since zooplankton and phytoplankton were the only plants and animals considered. The five reservoirs represented in the model were land, atmosphere, shallow sea, phytoplankton, and zooplankton. Zero usage of DDT after 1970 and continued use of DDT at the 1970 rate were the two hypothetical rates of future usage considered. The time required to return to equilibrium following discontinuation of DDT use is between 25 and 110 years but most of the decrease in residues occurs in the first few years. The concentration of DDT in marine life is already near equilibrium and will probably not increase significantly. A systematic study of the parameters of the model indicated that biological and chemical degradation rates for DDT, the amount of the pesticide which enters the atmosphere, the rates of transfer between deep and shallow seas, and the rates of direct absorption of DDT by plankton are critical factors in DDT circulation and distribution.

73-1547. Molyneux, F. (Dept. Chem. Eng., Seinburne College of Technol., Victoria, Australia). **Derris—a natural pesticide.** *Aust. Chem. Process. Eng. 25(11): 9-12; 1972.* (7 references)

Rotenone is the most potent of the six rotenoids occurring in Derris root. It decomposes on exposure to air with the formation of a hydroxyl derivative and then hydration to form dehydrorotenone. This decomposition occurs more rapidly in the presence of base. Chemical assay of rotenone and deguelin relies on the reaction of the methoxyl group with hydriodic acid to form methyl iodide which is converted to iodic acid and titrated with thiosulfate. Polarimetric methods of analysis are used in processing.

73-1548. Yule, W. N. (Chem. Control Res. Inst., Can. Forest. Serv., Dept. of Environ., Ottawa, Ontario, Canada). **Intensive studies of DDT residues in forest soil.** *Bull. Environ. Contam. Toxicol. 9(1): 57-64; 1973.* (11 references)

Approximately 6,000 tons of technical DDT were sprayed over 10 million acres of forest land around New Brunswick, Canada, for spruce budworm control from 1952-1968. DDT contents in soil profiles were investigated from 1967-1971 in a heavily-sprayed plot (70 ounces per acre between 1956 and 1967). DDT residues were largely confined to the surface organic layers (top 6 inches of soil). Residues found in 1968 accounted for about 10 ounces of DDT per acre. Residues decreased with elevation, confirming gravitational transport of DDT on inclined land. A projection of the average loss rate for DDT residues found on the plots gives an estimated half-life of less than 10 years in the forest soils

studied. Rates of loss within the three plots studied were variable, and contaminated foliage continued to drop to the ground for several years after spraying was stopped. The ratios of *p,p'*-DDE and, to a lesser extent, of *o,p'*-DDT, to *p,p'*-DDT increased with time. No significant amount of *p,p'*-DDD (TDE) was found.

73-1549. Bjerk, J. E. (Vet. Coll. of Norway, Dept. of Pharmacol. and Toxicol., Oslo, Norway). **Residues of DDT in cod from Norwegian fjords.** *Bull. Environ. Contam. Toxicol. 9(2): 89-97; 1973.* (16 references)

The use of DDT as an insecticide was prohibited in Norway as of Oct. 1, 1970, except for use against the pine weevil. DDT residues were determined in cod from various fjords to serve as a baseline in evaluating changes in residues with time. Fruit-growing and forest-nursery sites serving as DDT sources were located near some of the fjords. The mean DDT values in livers of 10-15 cod specimens from fjords near orchard land ranged between 12 and 40 ppm on a wet weight basis. Three specimens had DDT residues of 90-135 ppm in their livers. DDT values in cod from the fjords near the forest nurseries and away from known sources of DDT contamination were below 5 ppm. Maximum total DDT levels were found during May, and *o,p'*-DDT was also found in samples taken during May and June although not in November or April. DDT content of liver tissue was statistically correlated with fish size except during the spring breakup. Residue levels generally decreased with increasing distance from the orchard runoff source.

73-1550. Roemer-Maehler, J.; Bieniek, D.; Korte, F. (Organic Chem. Inst., Bonn Univ., Bonn, Germany). **Beitraege zur oekologischen Chemie. LIV. Solvolyse von Heptachlor und Dieldrin under hohen Druecken. [Contributions to ecological chemistry. 54. Solvolysis of heptachlor and dieldrin under high pressures.]** *Chemosphere 2(1): 31-33; 1973.* (9 references) (German)

Solvolysis of heptachlor and dieldrin under high pressure was studied. Heptachlor, dissolved in *n*-butanol, engaged in chemical reaction in the presence of small amounts of sodium hydroxide as catalyst under a pressure of 16 kbar and at 110°C to yield four compounds at 60% output. Hydroxychlordene and hydroxychlordene ether were determined as the main products. The highly stable epoxide ring of dieldrin showed no reaction in alkaline pH range under elevated pressure conditions. When catalyzed by acid, the epoxide ring of dieldrin present in a mixture of methanol with benzene under a pressure of 13 kbar and at a temperature of 140°C yielded 11 different compounds with aldrin-*trans*-diol, a ketal, and an enol ether as the main decomposition products.

73-1551. Li, G. C. (Univ. of Rhode Island, Kingston, RI). **A study of the interaction of atrazine with fractions of soil organic matter.** *Diss. Abstr. Int. 32(9): 4949B; 1972.*

The adsorption of atrazine onto humic acid was studied via the reaction of atrazine in absolute ethanol with an insoluble humic acid fraction. The reaction resembles Langmuir adsorption, and the equilibrium constants calculated from the Langmuir equation are 2.3×10^{-3} at 25°C and 7.6×10^{-3} at 3°C. According to the heat of adsorption calculated from the Clausius-Clapeyron equation, the adsorption of atrazine by humic acid probably results from hydrogen bonding. Major adsorption sites appeared to be carboxyl groups and/or phenolic hydroxyl groups. The hydrolysis of atrazine in aqueous solutions of different pH and in aqueous humic acid suspensions follows first-order kinetics. Both humic acid and acetate buffer ion reduced the energy barrier (Arrhenius activation energy) for hydrolysis of atrazine. The atrazine molecules apparently assume a more favorable geometry for hydrolysis in the presence of humic acid than in the presence of acetic acid. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-9796.)

73-1552. Hodges, L. R. (Univ. of California, Davis, CA). **Distribution and persistence of 1,2-dibromo-3-chloropropane in soil.** *Diss. Abstr. Int. 32(9): 4968B; 1972.*

The soil fumigant 1,2-dibromo-3-chloropropane (DBCP) was applied to various agricultural soils in California by injection, flooding, and sprinkling. Gas-chromatographic examination of soils revealed that DBCP was still present 40 weeks after application. The distribution of DBCP in soil was directly proportional to the size of the soil particles. It was greatest in sandy soils and least in clayey soils. In all but sandy soils DBCP movement was most rapid after injection application. DBCP was most persistent in soil after injection immediately followed by flood irrigation. After irrigation application, DBCP was retained near the surface in saturated soil, and so did not penetrate as deeply or rapidly. Subsequently, much was lost by codistillation with water. In laboratory tests DBCP was degraded in moist soil and sorbed to dry soil. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-9894.)

73-1553. Reidinger, R. F. (Univ. of Arizona, Tucson, AZ). **Factors influencing Arizona bat population levels.** *Diss. Abstr. Int. 32(10): 6128B-6129B; 1972.*

Current (1969 and 1970) estimates were compared with past estimates of over 20 Arizona and northern Mexico roosting-site bat populations. Eight of the populations contained no live members in the current visits, and a ninth contained only 1% of the members counted before. Human disturbance was frequently associated with populations showing downward trends. DDE, DDD (TDE), DDT, *o,p'*-DDT, dieldrin, toxaphene, and polychlorinated biphenyls (resembling Aroclors 1254 and

1260) were seen in one or more of the 104 organ samples from 58 bats representing 6 species. DDE was usually present in greatest concentrations. Residues in embryos were generally smaller than those in the dams. Residues were reduced in lactating adults. Total organochlorine residues on a whole-body basis in two insectivorous bats collected in areas of low insecticide use averaged 2.1 ppm; they averaged 4.9 ppm in 33 bats from areas of low to medium insecticide use, and 220 ppm in 10 bats from areas of medium to high insecticide use. These values are considerably higher than those in other mammals from similar areas. Residues in 11 of the 58 bats were sufficiently high to suggest acute toxic effects during periods of rapid lipid utilization; five are believed to have died from insecticide poisoning. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-13,274.)

73-1554. Jyothi, V. (Univ. of Florida, Gainesville, FL). **Miscible displacement of 2,4,-D herbicide during constant liquid flow velocity into initially dry soils.** *Diss. Abstr. Int. 32(12) Part 1:6776B-6777B; 1972.*

A theoretical model was developed for predicting the movement of organic chemicals through porous materials, and applied to the study of the movement of ^{14}C-labeled 2,4-D through glass beads, Lakeland fine sand, Fellowship subsoil, and Everglades mucky peat under constant flow velocities. Effluent samples from the packed columns were analyzed for 2,4-D by scintillation counting, and random samples were also analyzed chemically for 2,4-D to test for degradation. The herbicide did not degrade during transport. Diffusion produced a skewing of the observed curve toward the end of the experiment. The herbicide moved readily through glass beads, Lakeland fine sand, and Fellowship subsoil, whereas movement was very much hindered in Everglades mucky peat. Irreversible adsorption of 2,4-D also seemed to occur on the organic soils but not on the mineral soils. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-16,616.)

73-1555. Scott, H. D. (Univ. of Kentucky, Lexington, KY). **Diffusion of selected herbicides in water and in soil to soybeans.** *Diss. Abstr. Int. 33(2): 526B-527B; 1972.*

Diffusion coefficients of several ^{14}C-labeled herbicides in aqueous solution were approximately 0.6×10^{-5} cm^2/sec at 23°C. Essentially linear adsorption isotherms were obtained in Lanton silty clay loam, except in the case of atrazine, simazine, and prometone. The order of adsorption was 2,4-D < fluometuron < simazine ≈ atrazine ≈ diphenamid < prometryne ≪ chlorpropham ≪ trifluralin ≪ benefin. In soil the self-diffusion coefficients of 2,4-D, chlorpropham, trifluralin, and to some extent, diphenamid and prometone increased with time, presumably due to changes in structure resulting from microbial degradation. The magnitude of the resulting diffusion coefficients could generally be explained by the mobility of the known degradation products as well as the parent compound. Diffusion coefficients of the non-volatile herbicides were inversely related to the amount of adsorption, indicating most of the diffusion occurred in the solution phase. For more volatile herbicides, diffusion occurred in the vapor as well as the solution phase. The rate of diffusion increased as the soil water content increased for all herbicides except trifluralin. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-21,483.)

73-1556 Swanson, R. A. (Univ. of Arizona, Tucson, AZ). **Prediction of atrazine distribution and movement in soil systems.** *Diss. Abstr. Int. 33(2): 527B; 1972.*

Chemical and physical interactions which substantially affect atrazine movement and distribution in soils include adsorption and desorption of atrazine by Ca^{++}, Mg^{++} and Na^{+} saturated soil material, the effect of chloride salts of these cations on solubility of crystalline atrazine, and hydrolysis of atrazine by these materials. Adsorption follows the Freundlich isotherm forms reported in the literature. A hysteresis effect was encountered during desorption. The exponential desorption coefficient was equal to the exponential adsorption coefficient divided by 2.3. The effect of exchangeable cations on adsorption was within experimental error and the solubility of crystalline atrazine was exponentially related to the ionic strength of the solution. Using the equation developed, a computerized model was prepared to predict atrazine movement and distribution in soil systems. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-22,827.)

73-1557. Moyer, J. R. (Univ., of Saskatchewan, Saskatoon, Saskatchewan, Canada). **Some aspects of adsorption and desorption of herbicides with soil colloids.** *Diss. Abstr. Int. 33(3): 981B-982B; 1972.*

The adsorption of atrazine, monuron, and amiben to montmorillonite, kaolinite, silt, and peat was studied. Monuron was reversibly adsorbed to montmorillonite initially and after drying. In desorption experiments with prometryne and atrazine, less than the predicted amount of desorption occurred in immediate desorption analysis, but more desorption occurred than predicted by the adsorption isotherm after the drying treatment. With peat, monuron and atrazine were initially reversibly adsorbed; however, after drying the herbicide-peat mixtures to a constant weight at 62 or 85% RH, predicted desorption levels were not attained. About equal amounts of prometryne were desorbed when desorption was tested immediately and after drying. In all instances, the amount desorbed was significantly less than predicted from the adsorption isotherm. The effect

of adsorbents on the rate of breakdown of herbicides was studied. The calculated half-time (time for half of the herbicide to disappear) values for atrazine increased from 71 days in soil to 98 days in soil plus montmorillonite. Charcoal significantly reduced the rate of atrazine and chlorthiamid-dichlobenil disappearance from soil but had no significant effect on linuron disappearance from soil. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order no. 72-23,474.)

73-1558. Supak, J. R. (Texas A & M Univ., College Station, TX). **The volatilization, degradation, adsorption, and desorption characteristics of aldicarb (2-methyl-2-(methylthio)propionaldehyde *O*-(methylcarbamoyl) oxime) in soils and clays.** *Diss. Abstr. Int. 33(3): 982B; 1972.*

Pesticide volatilization from solid and solution aldicarb and from Houston Black (calcareous) and Beaumont (acid) soils amended with 1 mg of toxicant per g soil was determined by GLC analysis of trapped pesticide vapors. Volatilization losses of aldicarb were generally depressed by the presence of water (solution aldicarb) and elevated temperatures. The highest mortality rates among the bioassay organisms were observed in the 23°C soil systems which were being gradually dried by a stream of dry air. For all systems aldicarb volatilization losses ranged from 0.01 to 0.18% of the applied dose. Degradation of aldicarb at 23°C exceeded 10% of the applied dose only in the Beaumont soil where 24 and 46% of the added toxic material were lost from the moist and dry soil, respectively. At 42°C extensive degradation occurred in all systems; losses ranged from 38 to 82% in those allowed to attain an air dry state. Adsorption experiments with radiolabeled aldicarb revealed apparent negative adsorption (exclusion) of the toxicant on Ca- and Al-saturated montmorillonite clays. Infrared spectra of aldicarb-Ca-montmorillonite complexes showed two bonding mechanisms, hydrogen bridge bonding and coordination through the carbonyl oxygen, to be responsible for retention of aldicarb near basic clay surfaces. Aldicarb degradation appears to be initiated by protonation of the carbonyl oxygen and possibly the oxime nitrogen. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-24,336.)

73-1559. Wang, C. H. (Univ. of California, Davis, CA). **The effect of soil properties on losses of two chloronitrobenzene fungicides from soils.** *Diss. Abstr. Int. 33(3): 982B-983B; 1972.*

The effect of soil properties on the fates of two chloronitrobenzene fungicides, pentachloronitrobenzene (PCNB) and dichloronitroaniline (DCNA), in three California soils having substantial differences in organic matter level was studied in laboratory experiments. Under upland conditions (field capacity moisture) both fungicides were lost according to a first-order kinetic reaction. The half-times of PCNB were 4.7 months in Columbia fine sandy loam, 7.6 months in Sacramento clay, and 9.7 months in Staten peaty muck; those of DCNA were 30, 16.2, and 13.6 months respectively. Higher soil organic matter tends to retard PCNB loss but enhance DCNA loss. The effect of clay in soil is similar to that of organic matter. PCNB was lost mainly through volatilization, whereas DCNA was primarily lost through processes other than volatilization. Both fungicides were eliminated rapidly from soils by treatments which produce anaerobiosis, such as flooding or replacing the air with nitrogen or carbon dioxide at upland moisture. Losses under these circumstances were primarily due to microbial degradation. Pentachloroaniline was the major degradation product of PCNB; an unidentified pink compound was isolated by TLC from soil treated with DCNA. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-24,621.)

73-1560. Gale, A. F. (Univ. of Wyoming, Laramie, WY). **Evaluation of tillage plus herbicides for control of Canada thistle and their effect upon subsequent crops.** *Diss. Abstr. Int. 33(4): 1344B; 1972.*

Most herbicides which control Canada thistle are persistent in soil. In the present study tillage was used in conjunction with fall applications of dicamba alone or dicamba plus 2,4-D amine, and effects on a variety of crops were investigated one and two years after application. Some susceptible crops were damaged by persisting herbicide in the first year after treatment, but not during the second year. Residues detected in winter wheat grown in all rates of dicamba tested were within the tolerance limit of 0.5 ppm established for cereal grains. Residues exceeding the tolerance of 0.5 ppm were detected in oats, barley, and spring wheat grown in various dicamba treatments. Sugar beets from the plots treated with dicamba at 2 lb/A or less contained negligible residue. Residues of less than 0.01 ppm were detected in corn, alfalfa, dry beans, potatoes, and soils obtained from all dicamba applications. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-26,504.)

73-1561. Farvar, M. T. (Washington Univ., St. Louis, MO). **Ecological implications of insect control in Central America: Agriculture, public health, and development.** *Diss. Abstr. Int. 33(5): 1939B; 1972.*

Based on a team approach and using a variety of techniques, the impact of pesticides on agriculture, public health, and development in Central America and Guatemala were investigated. Malaria is still not controlled in this area, despite approximately 14 years of using DDT and other insecticides. Insecticides are also widely used on cotton plantations and small farms, despite lack of effectiveness and high cost. Safety pre-

cautions are very poor in the case of insecticide use by small farmers. The amount of DDT and several other insecticides in human milk from Guatemala is higher than amounts previously reported from anywhere else. The amount of DDT measured in 47 samples of human milk was from 12 to 436 times higher than the maximum acceptable daily intake established by the World Health Organization. Up to 70 ppm DDT was detected in fish samples from the Pacific coast and a highland lake. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-24,219.)

73-1562. Jewell, S. R. (Colorado State Univ., Fort Collins, CO). **Organochlorine pesticide concentrations in mule deer living near orchards in western Colorado.** *Diss. Abstr. Int. 33(6): 2427B; 1972.*

Organochlorine pesticides were determined in tissues from mule deer, *Odocoileus hemionus hemionus* (Rafinesque), living near orchards in western Colorado. No herbicides since 1963 and no insecticides were applied to public lands around the fruit district, and sources of pesticide contamination other than the orchards were few. Organophosphates and carbamates have been used in the orchards in preference to organochlorines since 1965. Levels of *p,p'*-DDT, *o,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD (TDE), *α*-BHC, *β*-BHC, *γ*-BHC, dieldrin, and endrin determined in deer and plant samples were generally below 100 ppb. Dieldrin and endrin were detected rarely from 1967 to 1969. The fluctuation in pesticide concentrations in muscle between seasons was attributed to seasonal changes in muscle weight. Fat samples generally contained higher organochlorine residues than other tissues studied, especially in summer. Browse plant samples collected from study plots generally contained low pesticide levels (less than 50 ppb), but samples collected in or near orchards shortly after spraying contained higher levels. The almost complete body fat turnover of the mule deer during winter promoted metabolism and excretion of the pesticides. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-24,219.)

73-1563. Naidu, S. M. (Mississippi State Univ., State College, MS). **Pesticide residues and their effects on microbial activities following massive disposal of pesticides in the soil.** *Diss. Abstr. Int. 33(7): 2894B; 1973.*

The relative persistence of eight pesticides and their effects on soil microbial populations were tested in a calcareous Trinity loam. Pesticides were applied to soil as analytical standards and commercial formulations to yield 5 tons active ingredient per acre and soil samples incubated for eight weeks. Recoveries of dieldrin, trifluralin, and DDT were approximately 95%, while only 13 and 19% of carbaryl and 2,4,5-T respectively were dissipated. Malathion, DBCP, and vernolate were readily dissipated. Persistence of formulations was similar to that of the analytical materials except for vernolate and 2,4,5-T. Only DBCP analytical standard and carbaryl formulation produced increases in total bacterial count. Streptomyces and fungi were less severely affected by the pesticide than other organisms. All analytical standards were inhibitory to carbon dioxide production by soil, whereas all formulations except that of vernolate increased carbon dioxide production. Nitrification was inhibited by the pesticides, whereas ammonification was scarcely affected. Urea hydrolysis was drastically reduced in treated soils. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-170.)

73-1564. Tarjan, R. (Inst. Dietetics, Budapest, Hungary). **Fremdstoffe in menschlichen Organen und Geweben als Indikator der Umweltverschmutzung. [Contaminants in human organs and tissues as an indicator of environmental pollution.]** *Ernaehrungsforschung 16(4): 479-480; 1971.* (German)

The general problem of contaminants in humans is reviewed. The relationship between contaminant levels in human organs and tissues and environmental contamination is demonstrated by a study of the DDT residue dynamics in a Hungarian population. Lipid-soluble substances such as organochlorines tend to accumulate in fatty tissues and lipid-rich tissues of the nervous system. Lymphoid tissues, due to their filtering effect, enhance the accumulation of contaminants. Fetal and embryonal tissues contained DDT, indicating the ineffectiveness of the placental barrier against DDT, and possibly also against other substances. A considerable percentage of human milk samples also contained organochlorine pesticide residues. Systematic investigations of DDT residues in a Hungarian population of nearly 500, conducted since 1960, revealed a relationship between the DDT residue levels and the overall amount of DDT used. The residues resulted from ingestion of animal rather than of vegetal food. DDT levels in adipose tissues decreased and a gradual metabolism of DDT into DDE and DDD (TDE) occurred since DDT use in Hungary was banned two years ago.

73-1565. Acker, L.; Schulte, E. (Inst. f. Lebensmittelchemie, Muenster Univ., Muenster, Germany). **Zum Vorkommen von Hexachlorbenzol und polychlorierten Biphenylen neben chlorierten Insektiziden in menschlichem Fettgewebe und in Humanmilch. [On the occurrence of BHC and PCB along with organochlorine insecticides in human adipose tissues and in human milk.]** *Ernaehrungsforschung 16(4): 559-567; 1971.* (10 references) (German)

Isomers of BHC, PCB, DDE, and DDT were determined and identified in human and avian adipose tissues and in human milk by a combination of thin-layer and gas chromatography with mass spectrometry. The

β-BHC, γ-BHC, DDE, and DDT residue contents in adipose tissues of deceased hospital patients and victims of traffic accidents ranged from 0.33-0.50, 0.021-0.044, 2.2-3.8, and 1.3-1.5 ppm on a fat basis. The PCB and BHC contents averaged 6.4 (4.3 to 9.3) and 5.4 ppm (3.6 to 9.5 ppm). The total of the DDT, PCB, and BHC residue content was about 15 ppm. The PCB to DDT + DDE ratio was about 1:4 and the BHC to DDT + DDE ratio 1:1. The β-BHC, DDT, DDE, and PCB residue contents in human milk were 0.54, 1.1, 2.7, 3.5, and 5.3 ppm, relative to milk fat. Adipose tissues of long-eared owls, sparrow hawk, and falcon contained 0.1-0.4 ppm of α-BHC, 0.1-13 ppm of γ-BHC, 0.2-0.7 ppm of β-BHC, 5.9-250 ppm of DDE, 24-740 ppm of PCB, and 1.9-210 ppm of BHC.

73-1566. Engst, R.; Knoll, R. (Zentralinst. fuer Ernaehrung, Akad. der Wissenschaften der DDR, Potsdam-Rehbruecke, DDR). **DDT- und DDE-Rueckstaende in Humanmilch. [DDT and DDE residues in human milk.]** *Ernaehrungsforschung 16(4): 569-575; 1971.* (16 references) (German)

Residues of DDT and DDE were determined in 75 human milk samples and in adipose tissue samples from 100 adults and 34 children in 1969 and 1970. The lower limit of detection for the applied thin-layer chromatographic technique was 0.05 ppm. The DDT residue levels were above 0.05 ppm in 96% of all human milk samples; three samples contained no DDE and another sample was DDT-free. The average DDT concentration was 0.23 ppm in 57 samples collected in 1969 and 0.16-0.41 ppm in another 20 samples collected in 1970. The *p,p'*-DDT and *p,p'*-DDE levels ranged from 0.05-0.25 ppm and 0.05-0.40 ppm. The total DDT, *p,p'*-DDT and *p,p'*-DDE concentrations in milk fat extract were 8.2 ppm, 2.5 ppm, and 5.1 ppm. The corresponding values obtained for extractable fat from adults and children were 13.1 ppm, 3.7 ppm, 8.5 ppm, and 6.9 ppm, 1.8 ppm, 4.6 ppm. The DDE to DDT ratio in extractable fats of milk and human fatty tissues was 7:3, which indicates no preferred elimination of DDT with human milk. Nearly 83% of 268 cow's milk samples investigated contained less than 0.02 ppm of DDT.

73-1567. Adamovic, V.; Sokic, B.; Petrovic, O. (Inst. Health Protect., Belgrade, Yugoslavia). **Zur Kenntnis der Faktoren, welche auf das Vorkommen der Organochlorinsektizide im Organismus der Neugeborenen einwirken. [On factors influencing the occurrence of organochlorine insecticides in newborns.]** *Ernaehrungsforschung 16(4): 579-585; 1971.* (5 references) (German)

Factors responsible for the presence of organochlorine insecticides in newborns were studied. Total DDT contents determined in brain and adrenal glands of newborns were 0.08-0.26 ppm and 0.21-0.63 ppm. Milk samples from three nursing mothers contained 3 μg of α-BHC, 11 μg of γ-BHC, 411 μg of *p,p'*-DDE, 9 μg of *p,p'*-DDD (TDE), 96 μg of *p,p'*-DDT, 5 μg of *o,p'*-DDT, and 79 μg of dieldrin per liter. Rates of daily excretion of the above substances with the milk were 3, 13, 547, 11, 120, 7, and < 4 μg/day. These findings suggest that the increased rate of total DDT excretion is due to mobilization of the maternal DDT. The daily α-BHC, γ-BHC, *p,p'*-DDE, *p,p'*-DDD, *p,p'*-DDT, *o,p'*-DDT, and dieldrin intakes by children consuming 600 ml of mother's milk daily in the first month were 2, 7, 246, 5, 58, 3, and < 2 μg/day. The principal effects of DDT in newborns include inhibition of corticosteriod synthesis and gluconeogenic enzyme activity and interference with calcium, vitamin D, and sex hormone metabolism.

73-1568. Szokolay, A.; Uhnak, J.; Rippel, A. (Res. Inst. Hyg., Bratislava, Czechoslovakia). **Ueber die Dynamik der Insektizidrueckstaende in Lebensmitteln. [Dynamics of insecticide residues in food.]** *Ernaehrungsforschung 16(4): 587-594; 1971.* (20 references) (German)

Studies of the dynamics of insecticide residues in foods and on the interactions of such residues with other food contaminants are reviewed. Milk samples investigated revealed a shift from DDT toward BHC residues and correlations between the organochlorine residue levels and the amount of pesticides used in a specific area. Compared to DDT, BHC had a higher retention in buttermilk and in low-fat milk. Turnips and corn grown on land treated with 5 kg of heptachlor per ha were fed to rabbits and ducks in a 16-week experiment. With the turnips containing < 0.5 mg of heptachlor per kg, rabbit liver and fat contained 9 and 10 times higher amounts of heptachlor epoxide at the end of the experiment. The heptachlor level in corn fed to ducks was 37 times less than that in turnips and did not accumulate in duck liver. An incubation test failed to reveal any significant difference in the decomposition of beta-carotene in fatty acid and butterfat with and without 10 mg of DDT and DDE per 1,000 ml. Methyl parathion present in canned orange juice, studied in another degradation test, decomposed through reduction of the nitro group primarily by the elementary tin of the can. Malathion, having no such reducible group, showed no such effect.

73-1569. Romminger, K.; Kubel, D. (Zentrale Lebensmittelhyg. Untersuchungsstelle, Berlin, DDR). **Beitrag zur Rueckstandsdynamik von Phosphorwasserstoff in Lebensmitteln. [Phosphine residue dynamics in foods.]** *Ernaehrungsforschung 16(4): 595-603; 1971.* (15 references) (German)

Phosphine residue concentrations were determined by the Kroeller photometric method in walnuts, hazelnuts, Brazil nuts, bitter and sweet almonds, peanuts, apricot stones, cashews, cocoa beans, palm seeds, poppy seeds, white beans, lentils, tobacco, dried apricots, raisins, cinnamon, black pepper, and milk powder 3 to 21 days after exposure to a phosphine concentration of

2,000 ppm. The residue concentration dropped below the acceptable limit of 0.01 mg/kg in 14 days in all samples except Brazil nuts. The organoleptic properties of all samples were normal after 14 days. Fumigation with phosphine can thus be recommended except for Brazil nuts; a lapse of 14 days should be observed before consumption.

73-1570. Quentin, K. E. (Inst. fuer Wasserchemie und Chem. Balneol., Techn. Univ. Muenchen, Munich, Germany). **Gewaesserschutz und Pestizidueberwachung. [Water protection and pesticide control.]** *Foed. Eur. Gewaesserschutz Informationsbl. 18: 45-47; 1972.* (7 references) (German)

General problems of water protection and pesticide control in West Germany are outlined. Contamination with pesticides is more frequent in surface waters than in groundwater, but the former are increasingly used for drinking and process water supply. A nationwide program for the monitoring of pesticides, trace elements, nutrients, and carcinogens in German rivers and lakes has been set up, and the Munich Institute has been entrusted with the control of the pesticide content of the 20 main drinking water reservoirs in West Germany. Samples are taken once to thrice yearly in the affluent, effluent, the surface layer, the epilimnion, the hypolimnion, and sediments, and also fish, macrophytes, and filter sludge samples are analyzed for pesticide residues. Tests show that surface waters still contain DDT in spite of the drastic cut in the DDT consumption during the past few years. Regular monitoring of pesticides in air concentrations revealed the presence of DDT, dieldrin, and lindane, with an overall concentration level of about 1 ng/m^3. Whereas the pesticide residue contents in water bodies are generally too small to be harmful in themselves, their hazards are enhanced by possible accumulation and synergism, especially in connection with heavy metals or oxygen deficiency. Massive death of fish and other aquatic organisms is a potential risk.

73-1571. Schmidt, K. (Inst. f. Wasserforschung GmbH, Dortmund, Germany). **Moeglichkeiten und Grenzen biologischer Verfahren zur Trinkwasseraufbereitung. [Possibilities and limitations of biological purification of drinking water.]** *Gas Wasser Abwasser 53(2): 38-49; 1973.* (32 references) (German)

Possibilities and limitations of mechanical, chemical, and biological purification of drinking water are reviewed, and experiments on the efficiency of slow sand filters in the retention of pesticides from drinking water during purification are described. A slow sand filter retained DDT dosed in the μg range quantitatively over 50 days, partly due to the adsorption of DDT on suspended matter and filter material. A complete elimination of hexachlorobenzene by sand filter was observed over 29 days. The percentage not retained afterwards was only 1.6%. Sand filters were able to retain less than 50% of lindane starting from the first day of application; the rate of malathion elimination increased to over 90% in five days, partly due to hydrolysis and microbial degradation. Sand filters were not able to decrease the dimethoate concentration. The rate of elimination of phosphamidon applied at a rate of 200 mg/l. decreased from 90% to 6% in 10 days. Sand filters were ineffective for linuron, diuron, and 2,4-D; however, 2,4-D showed decreasing concentration due to microbial degradation starting from the 5th day of introduction. Chlorination, ozonization, and especially activated carbon treatment effectively reduced pesticide concentrations in drinking water. Anaerobic filtration was suitable for the elimination of lindane residues from drinking water.

73-1572. Slatov, I. V.; Uporova, G. I.; Shtyler, S. Yu. (Smolensk Regional Sanitary Epidemiological Center, USSR). **Residual DDT and lindane in food products.** *Hyg. Sanit. 36(7/9): 313; 1971.*

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(8): 117; 1971, see abstract no. 72-0950.

73-1573. Stijve, T.; Cardinale, E. (Control Lab. of Nestle Products Tech. Assistance Co., Ltd., 1914 La-Tour-de-Peilz, Switzerland). **On the residues associated with the use of technical grade BHC with special reference to the occurrence and determination of three pentachlorocyclohex-1-ene isomers.** *Mitt. Geb. Lebensmitteluners. Hyg. 63(1): 142-152; 1972.* (23 references)

Foods were analyzed for BHC and its residues and methods devised for the isolation and determination of BHC degradation products in them. The presence of α-, γ, and δ-pentachlorocyclohex-1-ene isomers (PCCH) in commercial BHC-based insecticides was confirmed after preparation of two of the isomers. The procedure established to determine PCCH simultaneously with BHC isomers utilized an OV-17/QF-1 mixed phase column on a gas chromatograph with an electron capture detector. Confirmatory analysis was done with a second column and also with TLC on alumina. The concentration of PCCH isomers occasionally exceeded 10% in commercial insecticides containing BHC as a major ingredient. ε-BHC was seldom found in various foods because of its low persistence. Low levels of γ-BHC and occasional traces of α-BHC were found in cereals. Animal fats were generally contaminated by βBHC and sometimes by the α- and γ isomers. In milk from northern Europe where BHC contamination is low, the α-isomer made up about 70% of the total. All four isomers appeared in tropical milk where levels are high. PCCH isomers were mainly found in milk, but were detectable only when the total BHC content on a fat basis exceeded 0.2 ppm. BHC and PCCH residues were also found in vermicelli, tomato flakes, dehydrated mushrooms, and rice straw feed. Analysis for PCCH isomers should be included in pesticide monitoring programs.

73-1574. Anonymous. **DDT levels in barracuda.** *Nature (London) 241(5388): 309-310; 1973.* (1 reference)

In an editorial the implications of findings on organochlorine pesticides in the abdominal fat of Florida barracuda (see abstract 73-1301) are discussed. Pesticide monitoring programs have shown that most of the fish in U.S. waters contain DDT and often other organochlorines as well. Out of 281 giant barracuda analyzed in the referenced study, 63% had more than 5 g abdominal fat, and 96% of these "fat" fish contained DDT or its derivatives. Little abdominal fat was found in barracuda with fully developed gonads from the peak to the end of the spawning season. Calculation of total DDT concentration in other organs showed that the fish had lost approximately 75% of their total DDT. This loss was not due to starvation, and its cause is unknown. These findings indicate that a high whole-body DDT level in fish does not necessarily make the fish unsafe for human consumption, as the fat and oil containing the pesticide separate during cooking. The analysis of non-migratory fat accumulators such as barracuda is a useful method of estimating local pollution, as long as year-round analyses are performed; spot checking alone would lead to erroneous conclusions.

73-1575. Guinn, Vincent P. (Univ. of California, Dept. of Chemistry, Irvine, CA). **[Activation analysis in environmental pollution studies (including Hg, Pb, and pesticides).]** *Nippon Hoshasei Doigenso Kyokai (Radioisotopes) 20(11): 612-19; 1971.* (24 references) (Japanese)

Bromine in pesticide residues detected by neutron activation analysis is interesting from the following standpoint: ordinarily, these pesticides degrade in the soil or plants and form bromide ion; most foods contain a relatively small amount of bromide, usually less than 1-5 ppm. Therefore, unlike the extraction of organochlorines from food, the preliminary step of separating the residue from naturally contained bromide in food is not necessary. Recent bromide residue studies used an atomic reactor producing gamma rays. Dibromochloropropane (DBCP), a widely used effective pesticide for the soil, can cause accumulation of an excessive amount of Br in growing plants or excessive Br^- ion in the soil when used in large quantities. The bromide residue standard in the United States is 10-50 ppm. Another bromide-containing biocide is methyl bromide gas used effectively for preventing insect proliferation in grains. Excessive or repeated sprays can cause the residue level to exceed 50 ppm.

73-1576. Khurana, A. D. (Dept. Entomol., Haryana Agr. Univ., Hissar, India). **Persistence of systemic insecticides in plants.** *Pesticides 6(11): 21-24, 27; 1972.* (4 references)

Persistence of systemic insecticides in plants, based on effective control period, varies with the compound and mode of application and can be as high as 100 days. By using the foliar spray method, the insecticides can be applied at the proper time and a smaller quantity is required. Soil application tends to have side effects and seed treatment sometimes only gives partial control.

73-1577. Mishra, R. C.; Gupta, D. S. (Entomol. Sect., H. P. Agr. College, Solan, India). **Persistence of dimethoate in soils.** *Pesticides 6(11): 28-30; 1972.* (8 references)

The persistence of dimethoate in three types of soils was studied in the laboratory using a bioassay to test for residues. The material was thoroughly mixed with each type of soil and the treated soil placed in the upper four inches of a polyethylene bag. The half-life of the insecticide at 4 or 8 ppm was 5-7 days in the top 2 inches, and 5 and 14 days in the 2 to 4 inch layer. More leaching down occurred in sandy soil than in loam or clay loam. The maximum residue found in the lower, untreated soil was 39% of that applied and was observed five days after application.

73-1578. Maini, P.; Collina, A.; Passarini, I. (Soc. Italo Americana Prodotti Antiparassitari, SIAPA, Centro Esperienze e Richerche, 40015 Galliera, Italy). **Residues of chlorpyrifos in various crops. II. Residues after field treatment.** *Pestic. Sci. 3(5): 533-538; 1972.* (18 references)

Five agricultural crops were treated with chlorpyrifos granular or emulsifiable concentrate formulations at dosages from 0.5 to 6.0 kg(a.i.)/ha and at different periods before harvest. Chlorpyrifos residues were determined by gas chromatography after extraction and sweep co-distillation clean-up. Low residue levels were found. The average values in lettuce were 0.046 and 0.070 part/million, in sugar beet leaves 0.037 to 0.128 part/million and roots <0.005 to 0.038 part/million; no chlorpyrifos was detected in carrots, potatoes, and cured tobacco leaves at the limit of the method (0.005 part/million). (Author abstract by permission)

73-1579. Alumot, E.; Chalutz, E. (Div. of Animal Sci., Agr. Res. Cent., POB 6, Bet Dagan, Israel). **Fumigation of citrus fruit with ethylene dibromide: desorption of residues and ethylene evolution.** *Pestic. Sci. 3(5): 539-544; 1972.* (14 references)

The desorption of ethylene dibromide (EBD) residues from fumigated Shamouti citrus fruits is fitted by a single exponential equation at 17 and 22°C, and by an equation with a double exponential term at 5°C. Establishing the rate constant enables calculation of the initial concentration of EDB residues in the peel, thereby obtaining information on conditions during fumigation and on the possibility of peel injury development in the fumigated fruit. Healthy, harvested Shamouti citrus fruit evolve ethylene at a low rate, which is

increased by EDB fumigation. Fumigated fruit in which EDB caused peel injury evolved ethylene at a higher rate than fumigated fruit in which peel injuries did not develop. This information could be used for predicting peel injuries and in studies aimed at a better understanding of the processes leading to the development of peel injuries in fumigated citrus fruit. (Author abstract by permission)

73-1580. Elgar, K. E.; Steer, B. D. (Shell Res. Ltd., Woodstock Agr. Res. Cent., Sittingbourne, Kent, England). **Dichlorvos concentrations in the air of houses arising from the use of dichlorvos PVC strips.** *Pestic. Sci. 3(5): 591-600; 1972.* (14 references)

Twelve trials were conducted in the United Kingdom, Australia, and France in 1967-1970 to determine the concentrations of dichlorvos occurring in the air of houses when Vapona strips are used under normal conditions. Air samples collected in a three or four month period were analyzed for dichlorvos by an enzyme inhibition method. Out of 3000 air samples, 97.2% contained dichlorvos at 0.1 μg/l. or less. Concentrations up to 0.24 μg/l. were found in houses closed up due to the owners' absence or to use of several strips at a time. At the beginning of each trial, the dichlorvos concentration in the air rose rapidly, then fell exponentially. Concentration maxima averaging 0.04 μg/l. were attained at 1-2 weeks after strip placement in temperate area trials. Ventilation is apparently the most important factor in determining dichlorvos level in the air of a room. In the trials in Australia, with high air flow through the houses, dichlorvos concentrations were low. Increased ambient temperature increased the rate of dichlorvos emission from the strip, but the accompanying increase in ventilation outweighed the increased emission. Although kitchens were often smaller than the volume recommended for placement of strips, initial concentrations found in kitchens were not higher than in other rooms, and concentrations in kitchens declined more rapidly than in other rooms.

73-1581. Elgar, K. E.; Mathews, B. L.; Bosio, P. (Shell Res. Ltd., Woodstock Agr. Res. Cent., Sittingbourne, Kent, England). **Dichlorvos residues in food arising from the domestic use of dichlorvos PVC strips.** *Pestic. Sci. 3(5): 601-607; 1972.* (11 references)

Trials have been carried out with Vapona Pest Strips under practical conditions in houses in the U.K. and France. The purpose of these trials was to determine the residues of dichlorvos that occur in food prepared in kitchens in which strips were placed. Samples, each of which consisted of the combined food and drink for an adult for a day, were taken at intervals during the trials. The food items were exposed and the meals prepared, including any cooking, in the way normal to the household. The analyses for dichlorvos were carried out by a GLC method using flame photometric detection. The results show that the residue concentrations from all the individual samples were less than 0.1 part/million. In the U.K. trial the mean dichlorvos levels in samples taken 7, 42, and 70 days after the strips were hung were 0.03, 0.03, and 0.02 part/million respectively. In the French trial, the mean concentrations were a little lower, being 0.02, 0.02, and less than 0.01 part/million at the same times. The items of food and the way in which they were processed varied widely from sample to sample and also between the two countries. However, the residue concentration in a sample did not appear to be correlated with the food items or with the manner of processing. No relationship was observed between the volume of the kitchens used, which varied from 14 to 45 m^3, and the level of residues found in the samples. (Author abstract by permission)

73-1582. Griffiths, D. C.; Jeffs, K. A.; Scott, G. C.; Gair, R.; Lester, E.; Maskell, F. E.; Williams, J. H. (Rothamsted Exp. Station, Harpenden, Herts., England). **Biological effects of combining carboxin, organomercury fungicides and insecticides as seed dressings for wheat, and the effect of these combinations on adherence of the pesticides to the seed.** *Pestic. Sci. 3(5): 609-618; 1972.* (6 references)

When seeds of winter wheat were carefully dressed in the laboratory with combinations of fungicides (organomercury alone or organomercury plus the systemic fungicide carboxin) and insecticides (aldrin, carbophenothion or chlorfenvinphos as liquid formulations, or a γ-BHC powder formulation) so as to ensure that nearly all the recommended amounts of the active ingredients stuck to them, the insecticides gave good insect control, but γ-BHC with organomercury fungicide decreased the number of plants that germinated, and γ-BHC with carboxin and organomercury was even more damaging. Commercially dressed seeds had only about 30 to 60% of the target dose of fungicides, but more than 80% of the target doses of the liquid insecticides aldrin, carbophenothion and chlorfenvinphos. With combinations of powder fungicide and liquid insecticide, greater amounts of pesticide on the seed were obtained if the insecticide was put on first. Because of unusally late sowings and little fungal infestation, neither laboratory nor commercially treated seeds provided good tests for control of smut. (Author abstract by permission)

73-1583. Hayes, M. H. B.; Lundie, P. R.; Stacey, M. (Dept. of Chem., The University, Birmingham B15 2TT, England). **Interactions between organophosphorus compounds and soil materials. I. Adsorption of ethyl methylphosphonofluoridate by clay and organic matter preparations and by soils.** *Pestic. Sci. 3(5): 619-629; 1972.* (32 references)

Data for the adsorption of ethyl methylphosphonofluoridate from aqueous and the vapor phases

onto montmorillonite and kaolinite clays, onto soil organic matter preparations, and onto a limited number of soils are reported. These show that the phosphonofluoridate was absorbed from the vapour phase onto the dry clay preparations by physical-chemical forces but was not adsorbed by the organic soil materials. In a general way adsorption onto dry soils could be related to their clay contents when the organic matter contents were low. Water was found to compete effectively with the phosphonofluoridate for adsorption sites, and it is concluded that this molecule will be most effectively retained by dry soils low in organic matter and rich in clay. Mechanisms for its adsorption onto clays are discussed. (Author abstract by permission)

73-1584. Brown, G. E.; Albrigo, L. G. (Inst. of Food and Agr. Sci., Agr. Res. and Educ. Cent., P.O. Box 1088, Lake Alfred, FL 33850). **Grove application of benomyl and its persistence in orange fruit.** *Phytopathology 62(12): 1434-1438; 1972.* (16 references)

Benomyl, determined as the breakdown product MBC, was found in the juice and peel of oranges one day after application to trees at 300 to 500 μg/ml of benomyl. More than 70 days after spraying at those rates, residues up to 0.41 μg/g could still be detected in peel. Highest residues were always on the fruit surface, and translocation from the foliage to the fruit could not be demonstrated, indicating movement into the fruit from the surface. Rainfall apparently stimulated movement into the peel. Adjuvants such as Vapor Gard, Biofilm, or Nu-Film 17 usually improved disease control. More benomyl was found in the peel of the fruit initially than with benomyl alone, but after 30 days no differences were observed in residues.

73-1585. Cerna, V. (Inst. Hyg. Epidemiol., Prague, Czechoslovakia). **Vliv upravy a zpracovani ovoce a zeleniny na rezidua nekterych organofosfatu. [The effect of processing technology on organophosphate residues in fruit and vegetable products.]** *Prum. Potravin 23(12): 374-377; 1972.* (18 references) (Czech)

The effect of washing, boiling, and alcoholic fermentation on pesticides of Czechoslovak manufacture (fenitrothion, trichlorfon, dichlorvos, and malathion) in vegetables and fruits was studied. Malathion washes off easily while dichlorvos adheres rather firmly. Complete decomposition of a 50% aqueous solution of trichlorfon required 55 minutes of boiling. Decomposition of a buffered solution of the same percentage took 61 minutes, and a tomato juice solution, 50 minutes. Compared to trichlorfon, decomposition of fenitrothion in tomato juice proceeded very slowly. The trichlorfon residue in canned fruit amounted to 57.5% of the inital value of which 60% was in the syrup. The fenitrothion residue in canned fruit was 82% of the initial value and was entirely concentrated in the fruit. Dichlorvos was not detected. Prolonged storage reduces pesticide residues. After eight months the amount of trichlorfon was reduced by 11%, that of fenitrothion by 13.6%. The Henneberg medium was used for experiments with alcoholic fermentation. No reduction of trichlorfon levels was noted, whereas the quantity of malathion and of fenitrothion present decreased by 60%. Distillation removed all of the above pesticides; distillates were pesticide free and did not influence the organoleptic quality of the final products.

73-1586. Edwards, J. G. (Dept. of Biol. Sci.,California State Univ., San Jose, CA 95192). **DDT in British rain.** *Science 179(4077): 956; 1973.* (2 references)

A Letter-to-the-Editor (see abstract 73-0593) describing high levels of DDT in England's rain and similar concentrations in the U.S. is criticized in a reply. The references quoted in the letter by Woodwell et al. reported average DDT concentrations of 18-66 ppt (parts per trillion) in rain at seven British sampling stations and of 3 ppt over areas of agricultural England. No data was given for the United States. The applicability of these references as confirmation for Woodwell's reported figures of 73 to 210 ppt (which appeared in the original article as 73 to 210 ppm due to a typographical error) is questioned.

73-1587. Woodwell, G. M.; Craig, P. P.; Johnson, H. A. (Brookhaven Nat. Lab., Upton, NY 11973). **DDT in British rain.** *Science 179(4077): 956-957; 1973.* (4 references)

In reply to the letter of Edwards (see abstract 73-1586), the authors emphasize that the 73-210 ppt figures they reported are probably representative of total-DDT values in British rain. The 73 ppt value was the mean of four 3-month samples spanning a year at a sampling station in the Shetland Islands, the most remote station studied. The 210 ppt was the highest 3-month sample value and occurred in Camborne, Cornwall, in November-January, when high local DDT use could not be expected. The U.S. data was summarized in a reference of their original paper (see abstract no. 72-0246), which reported mean DDT concentrations in rainfall at three sites in Ohio as 75, 180, and 360 ppt. The maximum concentrations reported in the U.S. study were considerably higher than those reported in Britain, and therefore the implied comparison seems justified. The abrupt cessation of DDT use offers the opportunity of examining the behavior of a worldwide pollutant and resolving questions of world circulation, which formed the impetus for the authors' modeling attempt.

73-1588. Shapley, D. (Author address not given). **Herbicides: AAAS study finds dioxin in Vietnamese fish.** *Science 180(4083): 285-286; 1973.*

Fish and shellfish purchased in 1970 from fish markets located in areas of South Vietnam heavily

sprayed during the U.S. defoliation campaign contained significant quantities of dioxin. Implications and responses to these findings are discussed in an editorial. Samples were collected during a study trip made by the Herbicide Assessment Committee of the American Association for the Advancement of Science, and stored, frozen, awaiting the development of an assay method for extremely small quantities of dioxin. Results reported by Robert Baughman and Matthew Meselson at a conference on dioxins sponsored by the National Institute for Environmental Health Sciences revealed an average dioxin content of 540 ppt, with a range of 18 to 814 ppt. The results suggest, but do not prove, that bioaccumulation of the contaminant is occurring. Milk collected in 1970 from Vietnamese mothers is being analyzed. The new detection method employs time-averaged mass spectrometry and is suitable for investigation of soil, tissue, and many other sample types. It will be used to analyze liver samples from cattle grazed on rangelands sprayed with 2,4,5-T. Suspension of the use of 2,4,5-T and silvex, and restriction on the sale of surplus stocks of Agent Orange have been requested in response to these findings.

73-1589. Maugh, Jr., T. H. (Author address not given). **DDT: an unrecognized source of polychlorinated biphenyls.** *Science 180(4086): 578-579; 1973.* (4 references)

A report presented at the 165th national meeting of the American Chemical Society by K. W. Moilanen and D. G. Crosby stated that DDT vapor can be converted to polychlorinated biphenyls (PCBs) by irradiation with ultraviolet light at wavelengths encountered in the lower atmosphere. This would help to explain the extremely broad distribution of the relatively nonvolatile, insoluble PCBs. DDT in solution or as a thin film is essentially inert to sunlight, but in soil it is converted by some microorganisms to DDE. DDE formed rather rapidly from DDT vapor irradiated at 290-310 nm in the presence of a large excess of air. As much as 34% of the DDT present had been converted to DDT after four days of irradiation, and about 2% to DDD (TDE). Two molecules of DDE may interact directly but slowly to form small quantities of polychlorinated biphenyls. DDE is converted at a moderate rate, in the presence of a hydrogen donor, to DDMU, which in turn is converted at a moderate rate to 4,4-dichlorobenzophenone by interaction with oxygen. Dichlorobenzophenone is converted at a finite rate to 4,4′-dichlorobiphenyl, which is resistant to further conversion. Enrichment of environmental PCBs in less highly chlorinated biphenyls compared to the industrial compounds would point to photodegradation of DDT as a major source.

73-1590. Harvey, G. R.; Steinhauer, W. G.; Teal, J. M. (Woods Hole Oceanographic Inst., Woods Hole, MA 02543). **Polychlorobiphenyls in North Atlantic ocean water.** *Science 180(4086): 643-644; 1973. (10 references)*

Concentrations of polychlorobiphenyls (PCBs) have been measured at the surface and at various depths in the water of the North Atlantic Ocean between 26°N and 63°N. The concentrations average about 20 parts per trillion and amount to an estimated 2×10^4 metric tons of PCBs in the upper 200 meters of water. The average concentrations of PCBs in the surface water of the Sargasso Sea are lower than those in the northern North Atlantic. The PCB isomer composition found in most cases was best approximated by Aroclor 1254 (54% chlorine). Based on quantitative estimates of rates of production and rates of loss to the environment, a total DDT/PCB ratio of 10 would be expected in the North Atlantic, assuming similar half-lives for the two types of compounds. The observed ratio of less than 0.05 may mean that the environmental half-life of the PCBs is considerably greater than that of DDT and its metabolites. (Author abstract by permission, supplemented. Copyright 1973 by the American Association for the Advancement of Science)

73-1591. Dimitrov, S.; Naydenov, N.; Tatarov, B.; Vyleva, R.; Sapundzhieva, L. (Inst. Reprod. Biol. and Pathol. and Non-Infect. Diseases, Sofia, Bulgaria). **Issledovaniye travyanykh kormov na ostatochnyye kolichestva khlororganicheskikh i fosfororganicheskikh insektitsidov. [Investigation of herbage forages for organochlorine and organophosphorus insecticide residues.]** *Vet. Med. Nauki 8(9): 81-82; 1971.* (Russian)

Samples of herbage forages collected from different regions of Bulgaria were investigated for organochlorine and organophosphorus insecticide residues. Wheat crops were tested prior to harvesting and wheat straw prior to feeding; alfalfa was investigated both prior to harvesting and during the feeding period with special attention to methyl parathion and dipterex (trichlorfon) residues. Meadow hay from orchards was investigated for organochlorine insecticide residues when used for feeding. Wheat straw fed to the animals did not contain methyl parathion or dipterex residues, which indicates gradual decrease of the levels of these insecticides in wheat crops, reaching 10 μg per 100 g of forage by the 30th day after application. Samples of insecticide-treated alfalfa and hay samples from orchards treated with organochlorine insecticides contained DDT residues; aldrin was also detected in a few hay samples.

73-1592. Sasinovich, L. M. (Lab. Gen. Toxicol., All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastics, Kiev, USSR). **O gigiyenicheskoy otsenke DDVP v zerne i zernovykh produktakh. [Hygienic evaluation of DDVP in grain and grain products.]** *Vop. Pitan. 31(5): 60-63; 1972.* (5 references) (Russian)

Hygienic assessment of DDVP was performed in animal tests and maximum allowable DDVP (dichlorvos)

concentrations in grain and grain products established. The LD50 values determined for mice, rats, rabbits, and cats are 86.7, 65, 22.5, and 28 mg/kg body weight. The minimum effective dose determined in a 4-month experiment was 1.4 mg/kg and the subthreshold value 0.28 mg/kg in cats. Although DDVP has no cumulative property, it inhibits cholinesterase activity and interferes with liver function under chronic exposure. The DDVP content in grains, flour, and grits loaded into a grange five days after DDVP application ranged from 0.21 to 0.25 mg/kg during the first 7 to 10 days. Products prepared from contaminated flour and grits did not contain DDVP. The maximum permissible DDVP concentration in grain recommended is 0.3 mg/kg; grits and flour should be DDVP free.

73-1593. Antonovich, Ye. A.; Lyubenko, P. Kh. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastics., Kiev, USSR). **Vliyaniye nekotorykh pestitsidov na sostav i svoystva produktov rastitel'nogo proiskhozhdeniya (obzor literatury). [Effect of some pesticides on composition and properties of vegetable food products (a review).]** *Vop. Pitan. 32(1): 66-69; 1973.* (51 references) (Russian)

Data on the effects of pesticides on the chemical composition and properties of vegetables is reviewed. Triazine derived compounds decrease the rate of synthesis of sugars and increase the rate of sucrose hydrolysis and the accumulation of nitrogen-containing compounds in corn, sugar beet, oat, and hemp. Chlorophenoxyacetic acid derived compounds, though relatively unstable, may persist in the soil 5-9 months under specific conditions. Such compounds interfere with starch synthesis by inducing their hydrolysis, reduce the native protein, increase the amino acid and protein metabolite contents as well as the mineral phosphorus level. Certain carbamates may interfere with plant respiration and protein metabolism, increasing carbohydrate and reducing protein levels. Zineb and TMTD (thiram) increase the vitamin C, protein nitrogen, and carbohydrate levels in peas. Thiophos (parathion), trichlorfon, methyl mercaptophos, and Rogor (dimethoate) interfere with carbohydrate, protein, vitamin and mineral metabolisms, either decreasing or increasing these levels. The fumigant chloropicrin oxidizes unsaturated bonds in grain fatty acids and lipoproteins. Methyl bromide reduces the levels of thiamine and valuable amino acids in grains.

73-1594. Tunik, A. I.; Apanovskiy, L. N.; Prave, V. Ye.; Tikhotskaya, A. N.; Dernitsyna, Ye. A.; Minkina, T. A. (Moscow City Disinfection Station, Moscow, USSR). **Gigiyenicheskaya otsenka vozdushnoy sredy ob"yektov, obrabatyvayemykh khlorofosom. [Hygienic assessment of the air in spaces treated with trichlorfon.]** *Zh. Mikrobiol. Epidemiol. Immunobiol. 48(8): 17-20; 1971.* (3 references) (Russian)

A number of unventilated rooms were treated with 4-5% aqueous solution or 10% polymer solution of trichlorfon to determine trichlorfon concentrations in air samples. Trichlorfon was applied at doses of 8 g of technical grade trichlorfon or 70 ml of trichlorfon polymer solution per m^2. The trichlorfon concentration in air samples collected 1-3 hr after treatment in rooms with adequate ventilation ranged from 0.35 to 3.50 mg/m^3. Concentrations of 1.80 to 6.10 mg/m^3 were determined immediately after application. The trichlorfon concentration in rooms with insufficient ventilation decreased from 2.80 mg/m^3 to 0.25 mg/m^3 in 72 hr. The trichlorfon concentration in the air usually fell to the maximum allowable concentration of 0.5 mg/m^3 4-5 hr after application.

See also 73-1595 73-1596 73-1655 73-1659 73-1661 73-1667 73-1668 73-1676 73-1740 73-1752 73-1769

73-1595. Bailey, J. B. (Div. Agr. Sci., Univ. California, Berkeley, CA). **The effects of pesticide residues on farm laborers.** *Agrichem. Age 15(10): 6-10; 1972.*

Although regulations of the Environmental Protection Agency help to insure that agricultural products to be consumed do not certain hazardous pesticide residues, no uniform system has been set up to protect farm workers from such residues. Of the possible methods of reducing hazardous exposure, establishing worker re-entry periods where there is intimate and prolonged worker exposure seems to be the most promising. In a University of California study ethion and azinphosmethyl, applied to vineyards as wettable powder formulations, and Zolone (phosalone) and Dibrom (naled), as emulsifiable concentrate formulations, yielded leaf residues at harvest of 0.1 to 71 ppm. These residues caused significant blood ChE depression in workers although no symptoms were noted. The fact that effects were observed under conditions which were legal under the new California regulations suggests that further work is needed in this area.

73-1596. Anonymous. **New data on re-entry periods.** *Agrichem. Age 15(10): 7; 1972.*

Field tests at the University of California indicate that vineyard harvest and orchard thinning crews could return to the fields without risk to health in a shorter period of time than that established under preliminary tests. Tests in peach orchards showed no ChE depression in thinners entering the orchards 12 days after parathion application. Precise measurements of the removable residues of ethion, guthion (azinphosmethyl), and Zolone (phosalone) applied in concentrated and dilute formulations, though not complete, support this finding. A technique of "washing" the vineyards with water or water and detergent may prove to decrease the time of re-entry even further.

73-1597. Jones, G. R.; Owen-Lloyd, P.* (Neath General Hospital, Neath, Wales). **Recovery from poisoning by 20% paraquat.** *Brit. J. Clin. Pract. 27(2): 69-70; 1973.* (13 references)

A 15-yr-old boy recovered after accidentally ingesting paraquat (Gramoxone W) although there was evidence of renal, cardiac, and pulmonary involvement. Upon admission to the hospital 55 hr after exposure, the patient was placed on limited fluids and a protein-restricted diet and hydrocortisone therapy and prophylactic benzylpenicillin treatment initiated. Peritoneal dialysis was used for five days. The ratio of urine to blood urea was > 10:1, liver function tests remained normal, and urine paraquat levels were 200 and 0 μg/100 ml, 5 and 24 days after ingestion, respectively. Abnormal shadows appeared on lung x-rays, and then almost entirely disappeared. Abnormal lung function was observed. Inverted T waves and a prominent U wave were seen on ECG's taken about 10 days after ingestion; these returned to normal. Reexamination after three months revealed no abnormality in renal, cardiac, or pulmonary function.

73-1598. Tapfer, D. (Inst. Pub. Health, Semmelweis Med. Univ., Budapest, Hungary). **A bioaktiv veghuletek hatasa vadmadarak meszforgalmara es szaporodasara. [Effects of biologically active compounds on calcium cycle and reproduction of birds.]** *Budapesti Kozegeszegugy 3: 86-87; 1972.* (20 references) (Hungarian)

Observations of eggs and reproduction of a pair of owl eagles, *Bubo bubo* L., and of a pair of imperial eagles, *Aquila heliaca* L., nesting in Hungary, as related to their organochlorine pesticide intake, are described. Breakage of eggshells because of thinning was observed in the nest of owl eagles. Residues of DDE, DDT, γ-BHC, and β-BHC were determined in the embryos by reversed-phase paper chromatography. Egg weight decreased about 18%. The owl eagles subsequently disappeared from the long-established nesting site. Disappearance of a pair of imperial eagles was also observed in the same region. Observations during the last years before disappearance revealed no eggs in the nest.

73-1599. Cooke, A. S. (The Nature Conservancy, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, England). **Shell thinning in avian eggs by environmental pollutants.** *Environ. Pollut. 4(2): 85-152; 1973.* (278 references)

The role of environmental pollutants in eggshell thinning observed among a number of avian species is reviewed. DDE and other compounds and metabolites of the DDT group have been implicated in decreases in shell thickness observed in the field in N. America and Great Britain, primarily in birds of prey. In Britain cyclodienes have probably contributed to the problem; in N. America the cyclodienes and polychlorinated biphenyls appear to have played only a minor role. Mercurials have not been associated with shell thickness declines although these compounds, as well as organophosphates, could reduce shell thickness if encountered at high levels in the field. Experimental data generally substantiates the cause and effect relationship of the DDT-type compounds and shell thinning. On the basis of laboratory investigations gallinaceous species tend to be the most resistant and falcons the most susceptible. Various mechanisms have been proposed for the action of these pesticides, including reduction of calcium availability, reduction of carbonate availability, effects on other shell constituents, and changes in other factors involved in eggshell production like premature oviposition. No one mechanism is always dominant.

73-1600. Kolmodin-Hedman, B. (Div. Occup. Med., Dept. Occup. Health, Karolinska Inst., Stockholm, Sweden). **Decreased plasma half-life of phenylbutazone**

in workers exposed to chlorinated pesticides. *Eur. J. Clin. Pharmacol. 5(3): 195-198; 1973.* (11 references)

Subjects exposed to organochlorine insecticides, primarily lindane, exhibited a significantly lower plasma half-life of phenylbutazone compared to controls. After oral administration of a single dose of 5 mg/kg phenylbutazone, the PT1/2 was 63.9 hr in controls and 51.5 hr in exposed men. No relationship was found between the plasma level of lindane and the half-life of phenylbutazone. In men who had been tested for plasma half-life of aminopyrine two years before, no correlation was observed between the half-lives of the two drugs. Plasma levels of lindane were 0.02 ng/ml in controls and 18.4 ng/ml in exposed subjects. DDE levels (19 to 33 ng/ml) did not differ significantly. The induction of drug metabolizing enzymes was believed responsible for the differences observed in half-lives.

73-1601. Abukurah, A. R.; Moser, A. M.; Baird, C. L.; Randall, Jr., R. E.; Setter, J. G.; Blanke, R. V. (Dept. Med., Health Sci. Div., Med. College of Virginia, Virginia Commonwealth Univ., Richmond, VA 23219). **Acute sodium fluoride poisoning.** *Fluoride 6(1): 68-69; 1973.*

A report of recovery from intentional ingestion of 120 g of sodium fluoride, probably the largest dose ever ingested by man without fatal results, is summarized. Vomiting and excessive salivation occurred before admission to the hospital. Serum fluoride was 2 μg/ml. Measures taken included immediate gastric lavage (lime water) and administration of calcium gluconate intravenously. Endotracheal intubation, external cardiac massage, and intravenous administration of calcium gluconate and magnesium sulfate followed, prompted by tetanic contractions, respiratory arrest, and ventricular fibrillation. Initial respiratory and metabolic acidosis were corrected by administration of sodium bicarbonate, i.v. Epinephrine was given for cardiac arrest. Lidocaine was administered, but an intravenous atrial pacemaker was still necessary to control ventricular fibrillation. A convulsion was treated with diazepam. For four weeks lidocaine, fluids, and diuretics were given i.v.; feeding through a gastrostomy was necessary for 30 days.

73-1602. Burdygina, M. Ya.; Dumkina, G. Z. (Ufa Inst. Hyg. and Occup. Health, USSR). **Gigiyenicheskaya otsenka razlichnykh rezhimov obucheniya podrostkov professii apparatichka khimicheskogo zavoda pri kontakte s khlorom i khlorirovannyimi uglevodorodami. [Hygienic evaluation of different programs for training adolescents as apparatus operators in a chemical factory under conditions of exposure to chlorine and chlorinated hydrocarbons.]** *Gig. Sanit. 36(9): 39-42; 1971.* (5 references) (Russian)

Changes in physical parameters during training of students under 18 years of age as chemical factory workers using three different training schedules were analyzed. The air in the shops and grounds of the Ufa Chemical factory is polluted with a large number of toxic substances, especially chlorinated hydrocarbons although the maximum permissible level for any individual component is rarely exceeded. The training programs differed in the amount and distribution of time spent working in the factory. The students in 1½-month training programs, with about 1000 hr of factory time, worked in manufacturing 2,4-D and other compounds; fewer changes occurred in these students than in those on 18-month programs. Olfactory sensitivity decreased, diastolic blood pressure increased, cardiac stroke volume decreased, and the incidence of sinus bradycardia increased in all training groups. Uropepsin excretion decreased in the 18-month group. A decrease in serum proteins, especially γ-globulins, indicated diminished immunological activity. Failure of the positive santonin tests to normalize during the training period indicated persistent disturbances in the synthetic-oxidative function of the liver. All these changes are considered the result of excessive exposure to chlorinated hydrocarbons in young persons and necessitate increased safety precautions.

73-1603. Burdygina, M. Ya.; Dumkina, G. Z. (Ufa Occup. Health Res. Inst., USSR). **Hygienic evaluation of different regimens for training of adolescents as apparatus operators in a chemical factory under conditions of exposure to chlorine and chlorinated hydrocarbons.** *Hyg. Sanit. 36(7/9): 373-377; 1971.* (5 references)

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(9): 39-42; 1971, see Abstract no. 73-1602.

73-1604. Khasanov, V. Kh. (Khorezm Reg. Sanit.-Epidemiol. Center, Urgench, USSR). **A rare case of poisoning with water polluted by a pesticide.** *Hyg. Sanit. 36(7/9): 446-447; 1971.*

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(9): 96; 1971, see Abstract no. 72-0323.

73-1605. Seabloom, R. W.; Pearson, G. L.; Oring, L. W.; Reilly, J. R. (Dept. Biol., Univ. N. Dakota, Grand Forks, ND). **An incident of fenthion mosquito control and subsequent avian mortality.** *J. Wildl. Dis. 9(1): 18-20; 1973.* (6 references)

Nineteen warblers and a Swainson's thrush were tested from an estimated 5,000 to 25,000 birds which died following aerial application of fenthion for mosquito control. Levels of brain ChE activity were much lower than normal levels. Mean activities ranged from 0.09 to 0.35 μ moles of acetylcholine bromide hydrolyzed by 2 mg of brain tissue in 30 min. Factors other than avian toxicity might have contributed to the high mortality: variations in droplet size; a cumulative effect of overlapping applications; areas of high applica-

tion resulting from improper adjustment of spray apparatus; and the fact that the operation was carried out at the peak of warbler migration. It was recommended that ultra-low volume aerial application of fenthion be stopped. This has been done.

73-1606. Mirza, A. M.; Schaub, N.; Samler, L.; Reichelderfer, T. E.* (Div. Pediat., D.C. General Hospital, Washington, DC 20003). **Organophosphate insecticide diazinon poisoning in children.** *Med. Ann. D. C. 41(9): 559-560; 1972.* (4 references)

A non-fatal case of poisoning due to diazinon, an organophosphate of relatively low toxicity, is reported in a child. Diagnosis was made about one and a half hours after the child drank the insecticide contained in a soft drink bottle. Symptoms included disorientation, irritability, excessive salivation, pinpoint pupils, slurred speech, moist rales in the lungs, and generalized fasciculation of all the musculature of the extremities. A careful gastric lavage was performed and intravenous fluids, atropine, pralidoxime (700 mg), and antibiotics were administered. The child was discharged in 48 hr and was in good health one week later.

73-1607. Anonymous. **Birds and pollution.** *Nature (London) 240(5379): 248; 1972.*

The co-chairmen of a conference sponsored by the British Ornithologists' Union, the British Trust for Ornithology, and the Royal Society for the Protection of Birds, emphasized the importance of birds as indicators of environmental conditions. In a presentation at the conference, R. Risebrough stated that coastal and marine birds seem particularly vulnerable to interference by the persistent organochlorines and reviewed findings on reproduction declines in the brown pelicans of Anacapa Island. W. Bourne reported on oil pollution effects and population dynamics of seabirds around the coast of Britain. N. Moore contrasted hazards to birds in temperate climates, where major losses are due to destruction of habitat, with the problems in warmer areas, where the use of insecticides is required on a larger scale. Other participants reiterated the need for increased research on metabolism and effects of environmental pollution on wildlife.

73-1608. Sobelman, M. (Montrose Chem. Corp., Torrance, CA 90507). **DDT and pelicans.** *Nature (London) 241(5386): 225; 1973.*

The allegation by R. Risebrough (see abstract no. 73-1607) that reproductive failure in Anacapa Island pelicans is due to daily discharge of 500-1000 lb of DDT into the sea by a Los Angeles chemical factory is disputed in a Letter-to-the-Editor. The DDT production waste treatment methods of the Montrose Corporation, the alleged company, are outlined. For 25 years DDT effluents have been settled in a settling pond. The effluent to the county sewer line contained about 10-15 pounds of entrained DDT per day. This discharge was reduced to about 1 oz per day in 1971. Previous criticisms of Risebrough's statistical methods (see abstract nos. 73-0346 and 73-0850) are mentioned. Repeated citation of conclusions such as Risebrough's tends to establish them as fact despite continuing debate on their validity.

73-1609. Matsushita, T.; Arimatsu, T.; Misumi, J. (Sch. of Pub. Health, Fac. of Med., Kumamoto Univ., Kumamoto, Japan). **[Health disturbances due to herbicides used for forestry.]** *Nippon Kogyo Eisei Gakkai Nenkai Hokoku (Proc. Jap. Ind. Hyg. Soc. Annu. Meeting) 46:124-125; 1973.* (Japanese)

The effects of herbicides used for forestry such as chlorates and 2,2-dichloropropionates on the health of applicators were examined. Case studies and physical examination of the applicators and s.c. injections were used. The results showed that the herbicides caused skin eruption and reddening and itching papules which lead to discoloration of the skin. Major subjective symptoms included nausea (55%), dermatitis (32%), and loss of appetite (30%). LDH and inorganic phosphorus showed significant differences. Of 76 male applicators 6 persons were diagnosed as having contact dermatitis and 61 persons suspected dermatitis although not severe. Patch tests with 2,2-dichloropropionate showed no difference in positivity (23 and 16%) and quasi-positivity (46 and 42%) between the applicators and control.

73-1610. Matsushima, S.; Ide, H.; Hagiwara, A.; Yokoyama, T.; Oshiba, H.; Katsumata, C.; Takayama, C. (Dept. of Health Supervision, Saku Gen. Hospital, Nagano, Japan). **[On the health examination of persons engaging in plastic greenhouse cultivation and the investigation of the working conditions.]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 21(4): 414-426; 1973.* (1 reference) (Japanese)

The health of 24 men and 18 women engaged in carnation culture in plastic greenhouses was investigated. The subjects kept calendars over eight months on working hours, times and methods of pesticide application, and subjective symptoms. Concurrent test results on serum protein, hemoglobin, hematocrit, GOT, GPT, ZTT, and serum ChE activity were compared to those from more recent groups of workers and farmers. Residue concentrations in the air of the greenhouse were measured for traces of aldrin, fenitrothion, malathion, and diazinon. A "house cultivation disease syndrome" was apparent from the frequency with which pains in the shoulders and lower back, headaches, weakness in legs and general inertia, and excessive sweating occurred. The syndrome seems to be caused by excessive work without breaks, the posture required while working, the heavy pesticide concentrations which lowered serum ChE in the summer and after heavy labor, and the hot

and humid working atmosphere. The necessity for improved ventilation and protective measures during pesticide application is stressed.

73-1611. Ladefoged, A. M.; Kraul, I.; Karlog, O. (Author address not given). **Letale organkoncentrationer af dieldrin hos to kvier. [Lethal organ residues of dieldrin in two heifers.]** *Nord. Veterinaermed. 25(1): 46-47; 1973.* (3 references) (Danish)

The accidental poisoning of 13 heifers which had access to aldrin-dressed seeds is described. Eleven of the 13 animals died 4-6 days after ingestion of dressed seeds. Symptoms included convulsions, regurgitation, salivation, and excitation. Thin-layer chromatographic analyses revealed an aldrin concentration of 3,400 ppm and a dieldrin concentration of 2.4 ppm wet weight in dressed seed. The rumen contents, liver, kidney, adipose tissue, and brain of one heifer contained 2.3, 0.8, 0.3, 3.1, and 0.6 ppm of aldrin and 0.05, 10.6, 2.6, 38.4, and 4.3 ppm of dieldrin. The aldrin and dieldrin residue levels in the rumen contents, liver, and kidney of another heifer were 42.4, 0.4, and 0.2 ppm, and 0.3, 15.4, and 3.1 ppm. Aldrin is converted into dieldrin in the animal organism.

73-1612. Kangro, C. (Bartels und Rieger, Cologne, Germany). **Schutz bei der Anwendung giftiger Pflanzenschutzmittel. [Protective measures in the application of pesticides.]** *Staub 33(3): 150-153; 1973.* (German)

Problems of occupational safety are reviewed in connection with pesticide application. Adequate protective equipment should be used and evaluated for each pesticide and for the form in which it is applied: sprays, powders, gas-producing pellets, and liquids. Pesticides such as parathion, systox (demeton), meta-systox (methyl demeton), endrin, and toxaphene should be applied with a respirator worn. The most important part of the protective aspirator filter is the particulate filter which separates pesticides in the dust and mist particles. Pesticides which give off toxic gases and liquids such as hydrocyanic acid and methyl bromide and are used in warm weather and unventilated areas require respirator filters with increased amounts of activated carbon for adequate protection. The resulting vapor pressures and their dangers must also be monitored to prevent poisoning when pesticides are applied in very warm weather.

73-1613. Poloz, D. D.; Kokhtyuk, F. P.; Nikolayev, K. A. (All-Union Inst. Exp. Vet., Moscow, USSR). **Antidoty pri intoksikatsii zhivotnykh fosfororganicheskimi pestitsidami. [Antidotes for animals poisoned with organophosphorus pesticides.]** *Veterinariya (Moscow) 49(7): 93-95; 1972.* (Russian)

Mechanism of action, symptoms of poisonings, and antidotes for organophosphorus pesticides in animals are described. Lethal synthesis and partial dechlorination of several organophosphorus pesticides may occur within the animal. Basic poisoning symptoms include inhibition of the cerebral acetylcholinesterase, miosis, bronchial spasms, tremor and convulsions of the skeletal muscles, elevated blood pressure, excitation and paralysis of the central nervous system, loss of tone in the skeletal muscles, cyanosis, areflexia, intensified peristalsis, sialorrhea, hypersalivation, hypersecretion in the respiratory and gastrointestinal tracts, and diarrhea. Intramuscularly administered Tropacine, particularly combined with dipyroxime, was the best antidote for animals poisoned by organophosphorus pesticides. Poisonings with thiophosphates and dithiophosphates require repeated administration of these drugs. Atropine is less effective than Tropacine and dipyroxime, especially in cases of thiophosphate and dithiophosphate poisoning. Calcium chloride, vitamin B1, glucose and caffeic benzoate sodium are also useful antidotes for organophosphorus pesticides.

73-1614. Shoji, K.; Takagi, M. (Ehime Rosai Hospital, Yamaguchi Univ. Sch. of Med., Dept. of Ophthalmology, Yamaguchi, Japan). **[An outbreak of blind calves in the Niihama District. Relationship of these syndromes to agricultural chemicals.]** *Yamaguchi Sangyo Igaku Nenpo (Annu. Rep. Yamaguchi Soc. Ind. Health) 18: 27-32; 1972.* (21 references) (Japanese)

An unusual number of blind calves were born in recent years in the Niihama area of Ehime Prefecture. On three cattle farms 44 calves out of 195 (22.5%) in 1969, 21 out of 200 (10.5% in 1970), and 4 out of 100 (4%) in 1971 (one of the farms was closed in 1970) were born blind (69 blind calves out of 495 (14.5%) in three years). A relationship to agricultural chemicals was suspected and thorough investigations were conducted. However, in the vicinity of these farms only one farm used any kind of disinfectant (no pesticide) once a week or every ten days during the summer. No organophosphate or carbamate pesticides had been used anywhere in the area. Health examinations of the calves indicated no irregularities or illness, except for a slight anemic tendency of inner organs. Blind calves in general can be classified into three groups: those that lack various nutrients in their diet, including vitamin A; hereditary blindness, known to occur among Holstein calves; and pesticide poisoning or some other chemical poisoning. According to a report by J.T. Edgar, a serious case of poisoning by bracken had occurred in which 41 of 87 calves lost sight; 85.5% calves recovered sight when separated and treated. In the case of Niihama farms blind calves did not recover their sight after separation and vitamin A treatment. No poisonous food has been discovered in the area. Due to the barrenness of the area, nutritional insufficiency is suspected. With the living conditions and diet improved, there have been no blind calves in 1972.

73-1615. Klimmer, O. R. (Pharmakol. Inst., Univ. Bonn, Bonn, Germany). **Akute Vergiftungen durch Insektizide und Herbizide. [Acute poisonings with insecticides and herbicides.]** *Z. Allgemeinmed. 46(35): 1731-1734; 1970.* (German)

Symptoms, diagnosis, and therapy of acute poisonings with organophosphorus, organochlorine, carbamate, aromatic dinitro, and phenoxycarboxylic pesticides are reviewed. Cholinesterase inhibiting organophosphorus pesticides cause acute poisonings with symptoms such as miosis, headache, excessive perspiration, excessive bronchial and salivary secretion, muscular fibrillation, colic, bradycardia, and bronchial spasm. Death may be due to asphyxiation, pulmonary edema, or heart failure. Administration of atropine and oximes is useful. Poisonings with carbamates have symptoms similar to those of organophosphorus pesticides, but both the latency and duration of the poisoning are considerably shorter. Atropine, but no oximes, should be administered. The DDT type organochlorine pesticides cause poisoning symptoms such as nausea, loss of appetite, paresthesia, hyperesthesia in the face, mouth, and limbs, dizziness, gastroenteritis, tremor, epileptiform convulsions, ataxia, trismus, central respiratory difficulties, polyneuritis, and paralysis. Administration of activated carbon and i.v. administration of barbiturates are necessary. Dinitroorthocresol (DNOC) type aromatic dinitro compounds cause excessive perspiration, thirst, reddening of the skin, anxiety, excitation, fever, vomiting, diarrhea, cardiac arrhythmia, cyanosis, clonic-tonic spasms, pulmonary edema, and hepatic and renal damage. Electrolyte infusions and sedatives should be administered. The 2,4-D type phenoxyacetic acid derivatives, causing gastroenteritis, tetraplegia, central nervous system irritation, convulsions, and respiratory and circulatory failure, command symptomatic therapy. Paraquat type dipyridinium derivatives produce symptoms such as inflammation of the skin and buccal and gastric mucosa, gastroenteritis, renal and hepatic damage, and death due to proliferative terminal bronchitis, alveolitis obliterans, hemorrhage, and pulmonary edema. Therapy in intensive care units is necessary.

See also **73-1553** **73-1561** **73-1721** **73-1740**

73-1616. Cool, K. L.; Linder, R. L.; Progulske, D. R. (Dept. Wildl. Fish. Sci., S. Dakota State Univ., Brookings, SD 57006). **Adoptive behavior of caged pheasants exposed to chicks and dieldrin.** *Amer. Midl. Natur. 88(2): 262-269; 1972.* (17 references)

Dieldrin, administered at sublethal levels prior to adoption experiments with pheasants did not significantly affect the number of chicks adopted. In 1969, 11 hens treated with dieldrin adopted chicks compared to 13 controls, and 16 hens treated with dieldrin killed chicks compared to 9 controls. In 1970, 21 dieldrin-treated hens adopted chicks compared to 16 controls, and 9 dieldrin-treated hens killed chicks compared to 11 controls. In this study hens were treated for only three weeks and given free access to food and water. Wild hens would be exposed to pesticides over a longer period and would be subjected to the stresses of winter survival and spring reproduction. Sight and sound stimuli from chicks did not affect adoptive behavior of the hens. No significant difference was observed in the result when time of exposure to chick stimuli was varied.

73-1617. Fisher, H. K.; Clements, J. A.; Wright, R. R. (Pulmonary Sect., Univ. Arizona, Vet. Admin. Hosp., Tucson, AZ). **Enhancement of oxygen toxicity by the herbicide paraquat.** *Amer. Rev. Resp. Dis. 107(2): 246-252; 1973.* (31 references)

Nineteen out of 20 rats treated intravenously with 27 mg/kg paraquat dichloride and kept in an oxygen atmosphere died within 22 hours. None of the saline-injected controls kept in the same oxygen chambers died. In rats treated with the same dose of paraquat and kept in room air the average survival time was three days. Extensive perivascular and alveolar edema, abnormalities associated with longer exposure to oxygen alone at 1 atmosphere, were evident in lungs of paraquat-treated rats kept in oxygen. Lungs of rabbits, guinea pigs, and cats similarly treated also had signs of edema; paraquat-treated guinea pigs kept in air did not. The results suggest that paraquat damage in the lungs results from the potentiation of oxygen toxicity. Since this may also occur in man, it is recommended that supplemental oxygen be limited to the level necessary to bring about an acceptable arterial oxygen tension.

73-1618. Ippen, H.; Huettenhain, S.; Aust, D. (Universitaets-Hautklinik, Duesseldorf, Germany). **Klinisch-experimentelle Untersuchungen zur Entstehung der Porphyrien. II. Wirkung von Aethylalkohol auf die Hexachlorobenzol-Porphyrie der Ratte. [Clinical experimental studies on the genesis of porphyria. II. Experimental porphyria in hexachlorobenzene-treated rats: effects of ethyl alcohol.]** *Arch. Dermatol. Forsch. 245(3): 191-202; 1972.* (33 references) (German)

Possible effects of ingested ethyl alcohol on hexachlorobenzene (HCB) induced porphyria were studied in male Wistar rats and in CF I line male mice. The animals were given standard diet with 0.2% of hexachlorobenzene and drinking water with 5, 10, or 15% ethanol ad libitum. Animals fed HCB alone developed the impairment in urine porphyrin metabolism more rapidly than animals given a combination of 0.2% of hexachlorobenzene and 5% of ethanol. The onset of elevated urine porphyrin level was delayed with increased alcohol doses. The maximum porphyrin level determined for rats fed HCB without alcohol reached 32.5 μg/day compared to normal values of 10.2 μg/day and 24.9 μg/day determined in rats fed HCB with 5% alcohol. A combination of 5% alcohol with intermittently administered HCB did not retard the onset of porphyria. The liver weight in animals kept on 10% alcohol was higher than that of the control group. The results indicate no aggravating effect of alcohol on hexachlorobenzene-induced porphyria in rats.

73-1619. Budreau, C. H.; Singh, R. P. (Dept. of Anatomy, Health Sci. Cent., Univ. of W. Ontario, London, Ontario, Canada). **Transplacental passage of demeton in CF-1 mice.** *Arch. Environ. Health 26(3): 161-163; 1973.* (10 references)

The transplacental passage of demeton labeled with radioactive phosphorus (^{32}P) in pregnant CF-1 mice was followed autoradiographically in frozen sections of fetal and placental tissues. The organophosphorus insecticide was injected intraperitoneally on the 14th day of gestation at a dose of 5 mg/kg. Placental tissue, fetal muscle, and osteogenic mesenchyma were heavily labeled within 20 minutes, the radioactivity decreasing with longer periods of treatment. Liver incorporated demeton maximally between one and two hours. The compound appeared to be rapidly metabolized because fetal tissues showed only trace activity after three hours. (Author abstract by permission)

73-1620. Lloyd, J. W.; Thomas, J. A.; Mawhinney, M. G. (Dept. of Pharmacol., West Virginia Univ. Med. Cent., Morgantown, WV 26506). **2,4,5-T and the metabolism of testosterone-1,2-$^3H_2$ by mouse prostate glands.** *Arch. Environ. Health 26(4): 217-220; 1973.* (18 references)

High doses of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) (6.25, 12.5, or 25 mg/kg ten times daily) were administered orally to mature male mice. The herbicide 2,4,5-T significantly reduced the assimilation of radioactive androgen by the prostate gland ($P \leq .05$). This was reflected not only in a reduction in the total accumulation of testosterone-1,2-$^3H_2$ (T-$^3H_2$) by the prostate gland, but also in a decrease in the levels of its labeled metabolites. There was no change in the hepatic formation of either polar metabolites or of dihydrotestosterone, androstanediol, or androstenedione from T-$^3H_2$ in the 2,4,5-T treated mice. This pesticide had little or no effect on the weight responses of either the testes or the sex accessory organs. Prostate gland fruc-

tose, a chemical indicator of androgenic activity, was not altered by 2,4,5-T treatment. (Author abstract by permission)

73-1621. Nenner, M. (Inst. fuer Pharmakol. und Toxikol. der Univ. Goettingen, Germany). **Phosphorylation of acetylcholinesterase in bovine blood by paraoxon and soman.** *Arch. Toxikol. 30(2): 87-94; 1973.* (7 references)

In order to adjust reaction conditions to physiological conditions, phosphorylation of acetylcholinesterase has been investigated, not in highly diluted erythrocyte suspensions or enzyme solutions, but in undiluted whole blood. The inhibition of esteratic activity by paraoxon within 10 to 20 min, by soman within a few minutes, reaches the final level and shows no alteration during the next hours. This deviation from a pseudo first order kinetics is caused by the enzymatic hydrolysis of paraoxon, a competitive reaction by which paraoxon is destroyed rapidly. Soman did not show this effect, evidently because of the high velocity of the phosphorylation reaction. (Author abstract by permission)

73-1622. Peter, H. D.; Selhorst, P.; Dinnendahl, V.; Helm, K. U.; Schoenhoefer, P. S. (Dept. of Toxicol., Inst. of Pharmacol., Univ. of Bonn, Germany). **Effect of paraoxon and antidotes on lipolysis of isolated fat cells.** *Arch. Toxikol. 30(2): 139-145; 1973.* (17 references)

In experiments with isolated epididymal fat cells, paraoxon caused a dose-dependent inhibition of lipolysis in the LD50 dose range (10^{-7}-$10^{-5}M$). The inhibition occurred in unstimulated as well as stimulated lipolysis elicited by $10^{-6}M$ norepinephrine or $3 \times 10^{-3}M$ dibutyryl-A-3′5′-MP. The type of inhibition showed a noncompetitive pattern at an apparent $K_I = 1.1 \times 10^{-6}M$. Obidoxime, HS 3, and HS 6 did not abolish the 50% inhibition of maximum lipolysis elicited by $10^{-6}M$ paraoxon. Neither a reactivation nor a direct interaction between paraoxon and oximes was observed in this test system. (Author abstract by permission)

73-1623. Sakai, Y.; Dal Ri, H.; Schmidt, G. (Inst. fuer Pharmakol. und Toxikol. der Univ. Goettingen, Germany). **[Unterschiedliche Wirkungen der Organophosphate Paraoxon und Soman auf die Entladungsfrequenz in Einzelfasern des N. phrenicus der Ratte. [Different effects of paraoxon and soman on the activity of single fibres in the phrenic nerve.]** *Arch. Toxikol. 30(2): 147-159; 1973.* (22 references) (German)

The discharge pattern in single fibers of the phrenic nerve has been investigated in rats after inhibition of cholinesterase by the organophosphorus compounds paraoxon and soman. The results were: doses of 0.12 mg/kg paraoxon intravenously produced a neuromuscular paralysis while the frequency and number of spikes in phrenic nerve increased; soman (0.06 mg/kg intravenously) caused a decrease in the frequency of phrenic discharges; after application of atropine (1.0 mg/kg) the spike-interval in phrenic motoneurons was prolonged both in the paraoxon and soman intoxicated animals. The different effect of the organophosphorus compound paraoxon and soman on frequency of phrenic motoneurons offers an explanation for the fact that after soman acetylcholinesterase must be more inhibited to achieve neuromuscular paralysis of the diaphragm than in the case of paraoxon intoxication. The increase in frequency of phrenic motoneurons promotes the appearance of Wedensky-inhibition while the prolongation in the distance of impulses would suppress the neuromuscular paralysis by organophosphates. (Author abstract by permission)

73-1624. Dinnendahl, V.; Peters, H. D.; Helm, U. K.; Schoenhoefer, P. S. (Inst. of Pharmacol., Univ. of Bonn, Germany). **Studies on the mechanism of the antilipolytic effect of paraoxon.** *Arch. Toxikol. 30(2): 175-182; 1973.* (24 references)

Paraoxon exerts its antilipolytic effect on the lipolytic system of fat cells by a direct interaction with the triglyceride lipase. It does not affect other components of the lipolytic system such as adenyl cyclase, phosphodiesterase, ATP-levels or binding of cyclic 3′,5′-AMP-dependent protein kinase. Phosphorylation of protein mediated by cyclic 3′,5′-AMP-dependent protein kinase is not impaired by paraoxon. (Author abstract by permission)

73-1625. Vargova, M.; Kovalcik, V. (Vyskumny Ustav Hygieny, Bratislava, Czechoslovakia). **Interakcia heptachloru s pentobarbitalom. [Interaction of heptachlor with pentobarbital.]** *Bratislav. Lek. Listy 53(1): 30-36; 1970.* (Slovak)

The effect of heptachlor on the acute toxicity of pentobarbital, on its toxicity following repeated administration, and on the hypnotic effect of pentobarbital in rats and mice was studied. A single intraperitoneal administration of 25 mg/kg heptachlor followed 72 hours later by intraperitoneal administration of 70, 80, 90 or 100 mg/kg pentobarbital raised the LD50 of pentobarbital in rats from 80.6 mg/kg in control animals to 120 mg/kg in experimental animals. Repeated administration of 1 mg/kg heptachlor and of 100 mg/kg pentobarbital per day in mice also significantly increased the average time before death from pentobarbital. While the LD50 in the control group was reached after 6.4 days, in the experimental group the LD50 could not be established even 36 days after pentobarbital administration. A single administration of 25 mg/kg heptachlor to mice followed 96 hours later by 100 mg/kg pentobarbital reduced the duration of sleep from 125.8 ± 15.42 minutes in the control group to 20.2 ± 2.32 minutes in the experimental group of mice. When the pentobarbital

was injected after 192 hours the duration of sleep in the experimental group was 19.7 ± 3.4 minutes as compared to 146.3 ± 16.18 minutes in the control group.

73-1626. Krieger, R. I.; Lee, P. W.; Black, A.; Fukuto, T. R. (Dept. Environ. Toxicol. Univ. California, Davis, CA 95616). **Inhibition of microsomal aldrin epoxidation by diquat and several related bipyridylium compounds.** *Bull. Environ. Contam. Toxicol. 9(1): 1-3; 1973.* (8 references)

In vitro microsomal aldrin epoxidation was completely inhibited in the presence of 1m*M* diquat or 1m*M* paraquat. The I50 for diquat was $6.6 \times 10^{-6} M$. I50 values obtained for a number of compounds showed that the least potent inhibitor had a redox potential of -0.55 v and the most effective inhibitor had a redox potential of -0.18. Phytotoxicity was restricted to compounds with redox potentials between -0.3 and -0.5 v. The degree of inhibition did not change when diquat was preincubated with each of the components of the incubation misture. Bipyridyls probably inhibit microsomal oxidation by disrupting the microsomal electron transport system.

73-1627. Gundu Rao, H. R.; Anders, M. W. (Dept. Pharmacol., Univ. Minnesota, Minneapolis, MN 55455). **Inhibition of microsomal drug metabolism by anticholinesterase insecticides.** *Bull. Environ. Contam. Toxicol. 9(1): 4-9; 1973.* (20 references)

The effects of parathion, malathion, carbaryl and, for comparison, SKF-525A were investigated on in vitro activity of microsomal drug metabolizing enzymes using three different substrates. Parathion was about as potent an inhibitor as SKF 525A with ethylmorphine as substrate, and malathion and carbaryl were less potent. Using *p*-nitrosoanisole as substrate, malathion and carbaryl were less potent than SKF 525A. With aniline as substrate, all three insecticides were more potent inhibitors than SKF 525A. I50 values ranged from $2.5 \times 10^{-5} M$ for parathion to $8.4 \times 10^{-6} M$ for carbaryl. The organophosphates probably inhibit microsomal enzymes by serving as alternate substrates. Competitive kinetics were not obtained when inhibition of ethylmorphine *N*-demethylation and aniline hydroxylation by parathion was studied, suggesting that the interaction between the substrate, inhibitor, and enzyme is complex. Malaoxon and paraoxon were poor inhibitors of ethylmorphine *N*-demethylation. Malathion at levels sufficient to produce clinical signs of intoxication did not affect hexobarbital sleeping time or zoxazolamine paralysis time in vivo.

73-1628. Wagstaff, D. J. (Dept. of Vet. Physiol. and Pharmacol., Univ. of Missouri, Columbia, MO 65201). **Enhancement of hepatic detoxification enzyme activity by dietary mercuric acetate.** *Bull. Environ. Contam. Toxicol. 9(1): 10-14; 1973.* (25 references)

Experimental diet fortified with 100-5000 ppm of mercuric acetate was fed ad lib to 100-110 g female Holtzman rats for 15 days. The rats were killed; the liver was excised and homogenized and the 9000 *g* supernatant assayed for oxidative cleavage of EPN and *O*-demethylation of *p*-nitroanisole. Both of the examined detoxication activities were increased, in a roughly dose-dependent manner, by mercuric acetate ingestion. Weight gain and feed consumption decreased in proportion to mercuric acetate dose, and all animals in the 5000-ppm group died between the fifth and tenth days of the experiment. The stimulatory effects of mercuric acetate and phenobarbital on microsomal activity were synergistic. The EPN detoxication rate in control animals was 0.20 μ moles *p*-nitrophenol produced per gram of liver per hour; in animals given mercuric acetate in the diet at 500 ppm for 15 days, EPN detoxication was 0.34 μ moles/g/hr; in animals receiving 500 ppm phenobarbital, 1.07 μ moles/g/hr; and in animals receiving 500 ppm mercuric acetate plus 500 ppm phenobarbital, 1.74 μ mole/g/hr. The depressions of feed intake and body weight gain in mercuric acetate-treated rats were not affected by concurrent phenobarbital administration. Liver weight gains produced by phenobarbital administration were not altered by addition of mercuric acetate to the diet.

73-1629. Dziuk, L. J.; Plapp, F. W. (Dept. Entomol., Texas A & M Univ., College Station, TX 77843). **Insecticide resistance in mosquitofish from Texas.** *Bull. Environ. Contam. Toxicol. 9(1): 15-19; 1973.* (9 references)

Agricultural and urban streams contained mosquitofish (*Gambusia affinis*) resistant to DDT, toxaphene, and aldrin. The 48-hr LC50 values for DDT were 43 ppb with fish from an uncontaminated stream, 313 ppb with those from a stream draining a residential area, and 528 ppb with fish from a stream containing cotton field runoff. The 48 hr LC90 values reflected the same pattern of resistance. The highly DDT-resistant mosquitofish contained the highest residues of DDT and its metabolites. Whole-body residues averaged 50 ppm in fish from the agricultural stream while only low levels of *p,p'*-DDE were observed in fish from the urban stream. Aldrin and toxaphene residues were not detected, suggesting that the resistance was acquired by previous generations and then inherited. Cross-resistance was probably responsible for the aldrin tolerance since aldrin had not been used extensively near any of the test areas. Insecticide resistance found in *Gambusia* in Mississippi did not have an identical pattern.

73-1630. Phillips, W. E. J.; Hatina, G.; Villeneuve, D. C.; Becking, G. C. (Res. Lab., Health Protection Branch, Dept. of Nat. Health Welfare, Ottawa, Canada). **Chronic ingestion of lead and the response of the immature rat to parathion.** *Bull. Environ. Contam. Toxicol. 9(1): 28-36; 1973.* (14 references)

Progeny from rats raised through one generation on diets containing lead chloride at levels of 0, 2, 20, or 200 ppm were treated at 21 days of age with 0, 0.45, 0.90, 1.80, and 3.60 mg of parathion/kg. The level of dietary lead did not appear to affect rates of mortality to parathion observed within 24 hours. Serum ChE activities decreased about 25% but no lead interaction was observed in animals given doses of up to 1.80 mg parathion/kg. Dietary lead did not depress liver carboxylesterase activity, which was about 33% in controls treated with 1.80 mg of parathion/kg. Lead alone did not affect plasma or brain ChE or the percent inhibition observed when adult parent females were treated intraperitoneally with a dose of 2.5 mg of parathion/kg.

73-1631. Friend, M.; Haegele, M. A.; Wilson, R. (U.S. Bureau Sport Fish. Wildlife, Denver Wildlife Res. Cent., Denver, CO 80225). **DDE: interference with extra-renal salt excretion in the mallard.** *Bull. Environ. Contam. Toxicol. 9(1): 49-53; 1973.* (11 references)

Administration of DDE at 10, 100, or 1000 ppm in the diet had no effect on the chemical concentration of stimulated salt gland secretion in mallards maintained on fresh or salt water. Secretion after salt challenge was about twice as high in birds maintained on salt water as in those maintained on fresh water. The amount of sodium chloride excreted by fresh-water birds, but not salt-water birds, was markedly reduced by DDE administration. The greatest effect was observed 30 minutes following salt challenge. DDE seems to have no effect on extra-renal salt elimination in mallards whose salt glands have been previously stimulated with low level salt exposure, but can suppress it in birds not previously exposed. Interference with its function in juveniles not previously exposed to salt could result in the inability to eliminate toxic levels of salt taken in while feeding. This might explain some of the recent die-offs not accounted for by disease or environmental pollution.

73-1632. Dikshith, T. S. S.; Datta, K. K. (Ind. Toxicol. Res. Cent., Lucknow, India). **Endrin induced cytological changes in albino rats.** *Bull. Environ. Contam. Toxicol. 9(2): 65-69; 1973.* (18 references)

Endrin, administered to rats intratesticularly at a dose nine times less than the oral LD50, induced several chromosomal aberrations in male germinal tissues and cells. Stickiness, chromatin bridges, chromosome breaks, fragments, and ring chromosomes were observed. In some instances the severity of cellular damage caused liquefaction and transformation of the chromatin mass into an amorphous lump. No clinical symptoms of poisoning occurred at the dose administered.

73-1633. Schoor, W. P. (Dept. Pharmacol., Louisiana State Univ. Med. Cent., New Orleans, LA 70112). **In vivo binding of *p,p'*-DDE to human serum proteins.** *Bull. Environ. Contam. Toxicol. 9(2): 70-74; 1973.* (17 references)

Approximately 80% of the *p,p'*-DDE extracted from human serum was bound to proteins when serum was treated with sephadex and protein eluates were assayed for DDE. By diluting the serum sample before hexane extraction, as was done on elution from sephadex, *p,p'*-DDE was recovered in greater amounts and more consistently than in direct extraction. From preliminary data it appears that very little *p,p'*-DDE is found in the gamma globulin fraction. The amount of *p,p'*-DDE recovered decreased as serum samples were stored for more than 10 days at -15°C, indicating that the degree of binding changes as the conformation of protein changes.

73-1634. Cox, D. P.; Alexander, M. (Lab. of Soil Microbiol., Dept. of Agronomy, Cornell Univ., Ithaca, NY 14850). **Production of trimethylarsine gas from various arsenic compounds by three sewage fungi.** *Bull. Environ. Contam. Toxicol. 9(2): 84-88; 1973.* (9 references)

An attempt was made to isolate sewage microorganisms capable of producing trimethylarsine when cultured in the presence of various pesticidal arsenic compounds, especially those which are also intermediates in the proposed methylation pathway of arsenic. A 50-ml volume of isolation medium was mixed with sodium arsenite, sodium arsenate, monomethylarsonic acid, or dimethyl arsinic acid to a final concentration of 100 μg/ml. Each bottle was then treated with 2 ml of raw sewage and incubated at room temperature. After growth appeared, aliquots were successively transferred to media more concentrated in arsenic, to a final concentration of 200 μg/ml. If a garlic odor developed in the cultures, the organisms were isolated on agar plates. Three species of fungi were isolated which are capable of producing trimethylarsine from monomethylarsonic acid at pH 5: *Candida humicola, Gliocladum roseum,* and a *Penicillium* species. *C. humicola* produced trimethylarsine from all arsenic sources at pH 5: *G. roseum* and the *Penicillium* did not methylate arsenate or arsenite at pH 5-7.

73-1635. Webb, R. E.; Bloomer, C. C.; Miranda, C. L. (Dept. Biochem. Nutr., Virginia Polytechnic Inst. and State Univ., Blacksburg, VA 24061). **Effects of casein diets on the toxicity of malathion and parathion and their oxygen analogues.** *Bull. Environ. Contam. Toxicol. 9(2): 102-107; 1973.* (5 references)

Dietary levels of protein significantly affected the toxicity of malathion and parathion and their oxygen analogs in rats. The LD50 of malathion was 151.1 mg/kg with a 5% casein diet ad lib. and 273.6 mg/kg with a 20% casein diet ad lib. In rats fed 20% casein diets pair-fed to the 5% casein diet group the value was 418.6 mg/kg. Similar though less pronounced increases in toxicity with protein-deficient diets were observed for

the other compounds. Animals fed 20% casein diet excreted the greatest amount of *p*-nitrophenol during the first 12 hr after injection of parathion and paraoxon. The rats fed 20% casein ad lib. seemed to excrete less urinary *p*-nitrophenol than those fed 5% casein diet or 20% casein (pair-fed) in the first 24 hr. *p*-Nitrophenol excretion did not appear to have a direct relationship with the degree of toxicity of the pesticides. It is possible that the metabolic responses to lethal and sublethal doses, used in toxicity and excretion studies, respectively, are different.

73-1636. Rice, C. P.; Sikka, H. C. (Life Sci. Div., Syracuse Univ. Res. Corp., Syracuse, NY 13210). **Fate of dieldrin in selected species of marine algae.** *Bull. Environ. Contam. Toxicol. 9(2): 116-123; 1973.* (9 references)

Dieldrin accumulation and metabolism by species representing different taxonomic divisions of marine phytoplankton were investigated. *Skeletonema costatum* and *Cyclotella nana* represented the Bacillariophyta, *Amphidinium carteri* the Pyrrophyta, *Olisthodiscus luteus* the Xanthophyta, *Isochrysis galbana* the Chrysophyta, and *Tetraselmis chuii* the Euglenophyta; all were grown in axenic cultures. Maximum dieldrin uptake from a solution containing 1 ppb of ^{14}C-dieldrin occurred within 1 hour. Uptake increased linearly with increasing dieldrin concentration up to 1000 ppb. Since the maximum solubility limit of dieldrin in water is 100 ppb, the algae appear to have been incorporating dieldrin as small particles, or the saturation of dieldrin may have been maintained while algae concentrated dieldrin from solution. The uptake of dieldrin by algae increased in a non-linear fashion with increasing number of cells in the medium. The various species differed in rate of dieldrin removal from the medium. The degree of concentration of dieldrin by the algae was less than that observed with DDT, which may be due to the greater water solubility of dieldrin and its lower affinity for cellular lipids. TLC analysis of cell extract and culture media two weeks after incubation with ^{14}C-dieldrin showed only one compound, which co-chromatographed with authentic dieldrin.

73-1637. Cecil, H. C.; Harris, S. J.; Bitman, J.; Fries, G. F. (U.S. Dept. of Agr., Beltsville, MD 20705). **Polychlorinated biphenyl-induced decrease in liver vitamin A in Japanese quail and rats.** *Bull. Environ. Contam. Toxicol. 9(3): 179-185; 1973.* (22 references)

Young Japanese quail and rats were fed a control diet or one containing 100 ppm of *p,p'*-DDT or Aroclor 1242. After two months the animals were killed and the livers excised and analyzed. Both Aroclor 1242 and *p,p'*-DDT increased liver weight and liver lipids in male and female rats. Feeding DDT or PCB reduced liver vitamin A concentration in both male and female rats. The reduction in concentration was greater than that attributable to the corresponding increase in liver size. Total liver vitamin A in treated male and female rats was approximately half that in controls. In male quail PCB and DDT increased liver weight and decreased liver vitamin A. No effects of the treatments could be seen in female quail due to the great variations in individual data, presumably because of mobilization of liver constituents in formation of egg yolk. When egg laying was suppressed by maintaining the female quail in the dark from the onset of maturity, PCB and *p,p'*-DDT increased liver weight. PCB decreased liver vitamin A concentration to one-half of the control level and the total liver vitamin A to two-thirds of the control level. Aroclor feeding to female quail in standard lighting depressed egg production but did not affect egg weight or eggshell thickness.

73-1638. Rao, P. P.; Rao, M. R.; Visweswariah, K.; Majumder, S. K. (Infestation Control and Pestic. Cent., Food Technol. Res. Inst., Mysore 2A, India). **Comparative toxicological study of the new isolate X-factor and other components of BHC on albino rats.** *Bull. Grain Technol. 10(2): 89-96; 1972.* (12 references)

A comparative study was made of the toxicity of BHC, lindane, and X-factor, an isolate of the by-product of technical BHC obtained on removing lindane, fed at 50 ppm in the diet for eight weeks. Insecticide-fed animals exhibited no significant reduction in growth or difference in excretion of mercapturic acid, but excreted ethereal sulfate and glucuronic acid, indicators of organochlorine detoxication, in significant amounts. X-factor was concentrated by the body fat and liver to a greater extent than lindane or BHC. Excretion of metabolites was lower with X-factor than with the other insecticides. Blood picture and liver weights were not significantly altered by treatment. The only pathological changes observed were those in the kidneys of BHC- and lindane-treated rats.

73-1639. Lund, M. (Danish Pest Infestation Lab., Lyngby, Denmark). **Rodent resistance to the anticoagulant rodenticides, with particular reference to Denmark.** *Bull. WHO 47(5): 611-618; 1972.* (25 references)

Inherited resistance to anticoagulant rodenticides was discovered in populations of *Rattus norvegicus* about 14 years ago. Similar resistance has now been reported from several countries in north-western Europe and from the USA. In order to detect resistance and to control it effectively, basic data on the susceptibility of rat populations is required for each country, and trapping surveys should be made in any area where resistance is suspected. Acute poisons are needed to control resistant rats although the shift from anticoagulants to acute poisons is a retrograde step as far as efficiency is concerned and increases the hazard of control operations to man and other animals. Resistance

to anticoagulants in *Mus musculus* has been reported from England, and resistant mice are probably to be found in other countries also in view of the great individual variation in susceptibility of this species to these rodenticides. (Author abstract by permission)

73-1640. Mohandas, T.; Grant, W. F. (Dept. Genetics, Children's Hospital, Winnipeg, Manitoba, Canada). **Cytogenetic effects of 2,4-D and amitrole in relation to nuclear volume and DNA content in some higher plants.** *Can. J. Genet. Cytol. 14(4):773-783; 1972.* (20 references)

Amitrole and 2,4-D, applied to roots or germinated seeds of 12 species of higher plants induced the following chromosome aberrations: fragments, bridges, lagging chromosomes, polyploidy, differential chromosome contraction, and chromatin bodies. No clear dose response in the frequency of aberrations was observed with 2,4-D. Higher concentrations of amitrole and longer exposure produced more cytological abnormalities. No correlation was observed between nuclear volume or interphase chromosome volume and frequency of cells with chromosome aberrations after exposure to 2,4-D or amitrole. Sterility was not induced by 2,4-D. At 100 ppm, amitrole did not significantly affect sterility, and insufficient data was obtained at higher exposures to determine an effect. At 200 ppm, 2,4-D induced *albina* mutants, while amitrole did not induce any chlorophyll mutations.

73-1641. Ercegovich, C. D.; Chrzanowski, R. L.; Cole, H.; Herendeen, N.; Witkonton, S. (Pestic. Res. Lab., Pennsylvania State University, University Park, PA). **The relationship between the chemical structure of *s*-triazines and fungitoxicity to *Sclerotium rolfsii*.** *Can. J. Microbiol. 19(3): 329-334; 1973.* (21 references)

Thirty eight substituted *s*-triazine and three dialkyl biguanide analogs were tested for their effects on mycelial growth and the formation of sclerotia by *Sclerotium rolfsii*. None of the chemicals were fungicidal to the organism at a test concentration of 100μg/ml in potato dextrose agar. One of the chemicals, ipazine, was highly fungistatic, and 11 others demonstrated a significant but lower degree of activity against mycelial growth. The formation of sclerotia was completely inhibited in the presence of only one *s*-triazine, 2-amino-4-chloro-6-*n*-propylamino-*s*-triazine. Eight other *s*-triazines were as active as atrazine, the standard test chemical, in inhibiting the formation of sclerotia, and 10 more of the *s*-triazines were significantly effective but at a lower level of activity than atrazine. N^1,N^5-Bis(ethyl)-biguanide was the only chemical which caused a significant increase in the number of sclerotia formed. No absolute correlation was observed between biological activity and chemical structure although in certain instances there was an apparent correlation between toxicity and the overall electron withdrawing character of the non-alkylamino subsituent on the *s*-triazine ring, or to the steric effects caused by the configuration of the alkylamino substituents. Only those chemicals which were highly active as herbicides were significantly effective in inhibiting mycelial growth and sclerotia formation; however, not all of the herbicidally active compounds were effective in this regard. (Author abstract by permission)

73-1642. Elsner, E.; Bieniek, D.; Klein, W.; Korte, F. (Organisch-Chemisches Inst., Univ. Bonn, Bonn, Germany). **Beitraege zur oekologischen Chemie LII. Verteilung und Umwandlung von Aldrin-^{14}C, Heptachlor-^{14}C und Lindan-14C in der Gruenalge *Chlorella pyrenoidosa*. [Contributions to ecological chemistry 52. Distribution and transformation of aldrin-^{14}C, heptachlor-^{14}C, and lindane-^{14}C in the green alga, *Chlorella pyrenoidosa*.]** *Chemosphere 1(6): 247-250; 1972.* (3 references) (German)

Distribution and metabolism of ^{14}C-labeled aldrin, heptachlor, and lindane were studied in *Chlorella pyrenoidosa* cultured in nitrate nutrient solution at pH 5.6 and at 25 C. The pesticides were introduced after three days of incubation for culturing tests of 14 days. Aldrin, added in a concentration of 2.5 ppm, was found in the alga extract (48%), and in the nutrient solution (3%), while the rest was either evaporated or not extractable. Forty eight per cent of the radioactivity found in the alga extract was in the form of a metabolite identified by means of a reference substance as 1,2,3,4,9,9-hexachloro-1,4,4a,5,6,7,8,8a-octahydro-1,4-methanonaphthalene. Following application of 1 to 5 ppm of heptachlor, the alga extract contained an average of 66% radioactivity, and another 10% was detected in the nutrient solution. Sixty eight per cent of the radioactivity in the alga extract was due to heptachlor epoxide. Traces of three hydrophilic, unidentifiable metabolites were detected. Another metabolite, accounting for 7% of the alga extract radioactivity, was identified as 4,5,6,7,8,8-hexachloro-2,3-epoxy-4,7-methano-3a,4,7,7a-tetrahydroindon-1-one. A complementary test with ^{14}C-labeled heptachlor epoxide suggests metabolism of heptachlor to the above metabolite across epoxide as an intermediary. The respective proportions of the introduced radioactivity in the alga extract and nutrient solution, as determined 14 days after application of 1 ppm of lindane, were 22% and 45%. Small quantities of a metabolite, identified as 2,3,4,5,6-pentachloro-cyclohex-1-ene, were detected in both the alga extract and in nutrient solution ether extract.

73-1643. Hockwin, O.; Klein, W.; Korte, F. (Abteilung Biochemie des Auges, Univ. Bonn, Bonn, Germany). **Beitraege zur oekologischen Chemie LIII. Veraenderung der Enzymaktivitaeten der Linse des Auges durch Umweltchemikalien. [Contributions to ecological chemistry. 53. Changes in the enzyme activity of the**

lens due to environmental chemicals.] *Chemosphere 1(6): 261-266; 1972.* (12 references) (German)

An in vitro study describes the changes occurring in the enzyme activities of the eyes of cattle after introduction of aldrin, dihydrochlordene-1,3-dicarboxylic acid, buturon, DDT, 2,2′-dichlorobiphenyl, beta-dihydroheptachlor, and hexachlorobenzene. Homogenized cuvette samples of 3 ml were combined with 0.06 mg of dihydrochlordene-1,3-dicarboxylic acid, DDT, and beta-dihydroheptachlor, 0.12 mg of aldrin, buturon, and 2,2′-dichlorobiphenyl each, and 0.037 mg of hexachlorobenzene. Buturon, DDT, dihydroheptachlor, and hexachlorobenzene reduced fructoaldolase activity; dihydrochlordene dicarboxylic acid reduced glutamate pyruvate transaminase activity. Dichlorobiphenyl increased fructoaldolase activity; buturon and dichlorobiphenyl increased malate dehydrogenase activity; aldrin, buturon, and dichlorobiphenyl elevated NAD-sorbitol dehydrogenase activity; buturon and hexachlorobenzene increased glutamate pyruvate transaminase activity; dihydroheptachlor and hexachlorobenzene increased glycerokinase activity. Aldrin and DDT inhibited the glucose-6-phosphate dehydrogenase and dichlorobiphenyl inhibited hexokinase. Chemical residues interfering with metabolic processes of the eye are credited with furthering cataracts and decreasing transparency.

73-1644. Goto, M.; Hattori, M.; Miyagawa, T.; Enomoto, M. (Dept. Chem. Gakushuin Univ., Tokyo, Japan). **Beitraege zur oekologischen Chemie II. Hepatoma-Bildung in Maeusen nach Verabreichung von HCH-Isomeren in hohen Dosen. [Contributions to ecological chemistry. II. Hepatoma development in mice after administration of BHC isomers at high dosages.]** *Chemosphere 1(6): 279-282; 1972.* (4 references) (German)

Eight groups of 20 male ICR-JCL line mice each were daily fed 600 mg of technical BHC (Group 1), α-BHC (group 2), β-BHC (group 3) γ-BHC (group 4), a mixture of δ-BHC with ϵ-BHC (group 5), 1,2,4-trichlorobenzene (group 6), 2,3,5-trichlorophenol (group 7), or 2,4,5-trichlorophenol (group 8), respectively, for 6 months. Livers were significantly overweight in groups 1 through 4 when the animals were sacrificed after 26 weeks. Liver tumors with a maximum diameter of 2 cm with enlarged and atypical liver cell nuclei were determined in all animals of groups 1 and 2, in 8 out of 10 mice in group 5, and in 5 out of 10 mice in group 4. Hepatoma O-I was identified in all animals in groups 1 through 5, and a high incidence of hepatoma II (malignant) in groups 2 and 5 was determined.

73-1645. Ecobichon, D. J.; Stephens, D. S. (Dept. Pharmacol., Dalhousie Univ., Halifax, Nova Scotia, Canada). **Perinatal development of human blood esterases.** *Clin. Pharmacol. Ther. 14(1): 41-47; 1973.* (36 references)

In a study on the development of blood esterases in groups of premature infants of different gestational ages paraoxon was hydrolyzed at a rate about one half the adult rate of plasma arylesterase from premature (33 to 36 weeks gestation) or term infants. Activity in term samples was 34×10^4 μmoles/min/ml of plasma compared to 61.0 μmoles/min/ml in young children and 73.0 μmoles/min/ml in adults. Levels of plasma proteins and hydrolytic enzymes increased during the last weeks of gestation and the first year after birth. The study suggests that infants might differ significantly from older children and adults in the capacity to bind drugs or hydrolyze ester-type compounds.

73-1646. Swartz, R. D.; Sidell, F. R. (Edgewood Arsenal, MD). **Effects of heat and exercise on the elimination of pralidoxime in man.** *Clin. Pharmacol. Ther. 14(1): 83-89; 1973.* (15 references)

Environmental stresses altered the fate of pralidoxime in man when it was administered with *p*-aminohippurate (used to estimate renal plasma flow). Plasma half-life values increased with exercise. Volumes of distribution were larger under all stress conditions in both the central and peripheral compartments. Recovery of pralidoxime from urine varied in the first three hours from 84% of the dose in resting subjects to 73% in heat-stressed subjects. Changes in renal clearance, measured by creatine excretion, did not totally account for observed differences. Approximately 10% of the administered dose was recovered in all cases between 3-24 hours. Apparently the phenomenon of distribution altered by exercise and heat exposure significantly increased overall drug removal from plasma in view of reduced renal drug removal. Drug metabolism may occur in newly distributed areas.

73-1647. Carlson, G. P. (Dept. of Pharmacol. and Toxicol., Coll. of Pharmacy, Univ. of Rhode Island, Kingston, RI 02881). **Detoxification of foreign organic compounds by the quahaug, *Mercenaria mercenaria*.** *Comp. Biochem. Physiol. 43B(2): 295-302; 1972.* (18 references)

The hepatopancreas of the quahaug, *Mercenaria mercenaria*, was examined for ability to oxidize or reduce foreign organic compounds. Quahaug hepatopancreas was unable to metabolize the insecticide EPN, *O*-demethylate *p*-nitroanisole, *N*-demethylate aminopyrine or oxidize hexobarbital. Quahaug hepatopancreas was able to reduce *p*-nitrobenzoic acid to *p*-aminobenzoic acid. The reaction was maximal at 35-45°C and a pH of 6.0. It was stimulated by flavins and inhibited by potassium cyanide but not by SKF-525A or carbon monoxide. Nitroreductase activity was also found in mantle, gill, foot, and gonadal tissue to a lesser extent. (Author abstract by permission)

73-1648. Levain, N.; Marano-Le Baron, F. (Lab. de Biol. Cellulaire Vegetale, Montrouge, France). **Etude des effets d'un insecticide organochlore, le lindane, sur la croissance et la structure de deux Algues unicellulaires, l'*Euglena gracilis* Z. et le *Dunaliella bioculata*. [Study of the effects of an organochlorine insecticide, lindane, on the growth and structure of 2 unicellular algae, *Euglena gracilis* Z. and *Dunaliella bioculata*.]** *C. R. Acad. Sci. (Paris) Ser. D 276(1): 37-40; 1973.* (5 references) (French)

The effects of 1-60 μg/ml concentrations of lindane on the growth and structure of *Euglena gracilis* Z. in Cramer-Myers medium and *Dunaliella bioculata* in Miquel saline solution were studied. The light intensity applied for the two species was 4,000 and 2,000 lux, respectively. Lindane was introduced into the culture in acetone solution prior to inoculation. Lindane concentrations above 30 μg/ml suppressed the proliferation and morphological changes of *Euglena gracilis* Z. Concentrations of 50-60 μg/ml totally inhibited growth. High doses initially caused discoloration, loss of motility, and degeneration during the first few days of exposure; growth, coloration, and motility later returned to normal. Lindane concentrations of 10-30 μg/ml caused transitory vacuolization of the cytoplasm, chloroplasts, and mitochondria during the first few days of exposure. Five to ten μg/ml concentrations of lindane partially or totally inhibited the growth of *Dunaliella bioculata*. Concentrations above 5 μg/ml first resulted in the appearance of two or three pairs of flagella and several pyrenoids; later, loss of flagella and sedimentation were observed. Algae transferred into lindane-free culture after having been kept in culture with 5-10 μg of lindane per ml over five days gradually normalized. The results indicate increased susceptibility to lindane by *Dunaliella bioculata* as compared to *Euglena gracilis* Z., and reversible effect of lindane on both species.

73-1649. Hoque, M. Z. (Dept. Agron., Univ. Philippines, Los Banos College, Laguna, Philippines). **Carbaryl—a new chemical mutagen.** *Curr. Sci. 41(23): 855-856; 1972.* (4 references)

Mutagenic properties of carbaryl were studied by treating wild-type female *Drosophila*. Cytological observations were made on the third instar larvae of the F_1 and F_2 generations with all concentrations of carbaryl (1, 5, and 10 ppm) tested. At 5 ppm more males than females were produced. Black-eyed and white-eyed flies were produced and white-eyed flies had head and thorax merged. Deficiency, duplication, inversion, reciprocal translocation, and asynopis of homologous chromosomes were observed.

73-1650. Smith, R. M. (Univ. of Massachusetts, Amherst, MA). **The effect of gametic concentrations of DDT and dieldrin on reproduction in winter flounder.** *Diss. Abstr. Int. 32(12) Pt. 1: 6764B; 1972.*

Prespawned adult winter flounder were sublethally dosed with DDT and dieldrin to establish gametic concentrations of the insecticides. Residues in the eggs from dosed flounder ranged from 0.39 to 4.60 ppm DDT, 0.07 to 0.72 ppm DDE, and less than 0.01 to 1.74 ppm dieldrin. No residues of either insecticide were detected in the milt from dosed male flounder. Heavy mortality was encountered in prefertilized ova which contained more than 1.00 ppm dieldrin, and in one case with DDT at 4.60 ppm. Insecticide residues in the gametes did not directly affect percent fertilization. Egg concentrations of DDT above 1.62 ppm caused lethal effects in the developing eggs between the second and fourth days of development and at hatching. Mortality between the second and fourth days of development was associated with a failure to undergo normal gastrulation. Mortality at hatching was frequently seen with vertebral deformities. Bone erosion with hemorrhaging at the vertebral junctures was observed. Survival in the eggs from dieldrin dosed adult flounder was similar to that in controls. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 72-18,040.)

73-1651. DeMur, A. R. (Univ. of California, Riverside, CA). **Effect of several environmental factors on the toxicity of the herbicide siduron and mechanism of its action.** *Diss. Abstr. Int. 32(12) Pt. 1: 6766B-6767B; 1972.*

The effects of siduron, a substituted urea herbicide, were studied on susceptible bermudagrass (*Cynodon dactylon* L.) and resistant bluegrass (*Poa pratensis* L.). Studies with ^{14}C siduron showed absorption and translocation in the foliage; there were no significant differences in the amounts of radioactivity in roots and shoots of both species. Differences in the rate of metabolism were observed between the species. After partitioning between chloroform and water, most of the radioactivity was found in the water phase in the bluegrass extracts, whereas in grass extracts it was in the chloroform phase. Siduron metabolites present in the water phase after partitioning were conjugated in the form of glycosides: two metabolites were found after enzymolysis, chloroform extraction, and TLC; one was identified as a hydroxylated derivative of siduron. The greater ability of the bluegrass plants in metabolizing siduron appears to be responsible for resistance. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-17,037.)

73-1652. Mehrle, Jr., P. M. (Univ. of Missouri, Columbia, MO). **Amino acid metabolism of rainbow trout (*Salmo gairdneri*) as affected by chronic dieldrin exposure.** *Diss. Abstr. Int. 33(1): 95B; 1972.*

Administration of dieldrin to rainbow trout in the diet at 143μg/kg body weight per day for 140 days sig-

nificantly altered serum alanine, valine, isoleucine, threonine, methionine, phenylalanine, aspartate, glutamate, lysine, tryptophan, and cystine. Forced swimming enhanced the effects of dieldrin on amino acid metabolism. Chronic dietary dieldrin administration to rainbow trout at 14-430μg/kg body weight per day for 140 days increased liver GDH activity, decreased brain GOT, GPT, and GDH activities, and stimulated glutamine transferase activity. Brain amino acids were altered at dieldrin concentrations of 143 and 430 μg/kg. Aspartate and alanine concentrations were significantly increased, possibly due to inhibition of brain GOT and GPT activities. Glycine and GABA concentrations were significantly increased, with the implication that these had a dampening effect on neural activity. Brain ammonia concentrations were not altered by any dosage of dieldrin whereas serum ammonia concentration increased in the two highest dosage groups. Since ammonia detoxifying activity and phenylalanine hydroxylase activity were affected by all tested dieldrin dosages, the no-effect level is below 14 μg/kg weight/day. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-19,228.)

73-1653. Del Rosario, D. A. (Michigan State Univ., East Lansing, MI). **Enhancement of phenylurea herbicide activity with carbaryl and diazinon.** *Diss. Abstr. Int. 33(2): 514B-515B; 1972.*

Numerous herbicide-insecticide combinations were applied to the foliage of tolerant and susceptible plants to detect synergisms which might occur. Increased injury was obtained with a combination of linuron and carbaryl in tolerant carrots. Leaf tissue respiration was not affected by either chemical alone, but the photosynthesis rate in the presence of both chemicals was greatly reduced. The rate of linuron uptake was increased by carbaryl while the rate of linuron metabolism in the presence of carbaryl was decreased. Diazinon enhanced the toxicity of linuron, monolinuron, monuron, and diuron in carrots, cotton, and corn, apparently by enhancing uptake. Metabolism of the phenylureas in cotton leaves was unaffected by the presence of diazinon. The dimethylureas were more easily degraded by cotton than the methoxymethylureas, and the monohalogenated analogs were more rapidly metabolized than the dihalogenated analogs. The selectivity of phenylurea herbicides is related to both differential uptake and metabolism in different plant species. Selectivity can be impaired by addition of other pesticides which enhance uptake or inhibit degradation of the herbicides. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-22,209.)

73-1654. Bishara, R. H. (Purdue Univ., Lafeyette, IN). **A radiotracer distribution study of *p,p'*-DDT in rats and the effect of some physical and chemical factors on its excretion.** *Diss. Abstr. Int. 33(2): 675B-676B; 1972.*

Studies were conducted to evaluate the effects of some physical and chemical factors on the elimination of DDT. In preliminary studies the chromatographic behavior of DDT and fourteen related compounds on precoated aluminum oxide thin-layer chromatoplates was investigated using 33 solvent systems. Color and/or fluorescence responses were obtained at 0.05-0.25 μg with a reagent comprising ammoniacal silver nitrate and 2-phenoxyethanol. An increase in number of chromatographic spots, corresponding to the number of development steps, following exposure to short-wave UV light during development indicated interaction of DDT with components of the TLC plate. When radiolabeled DDT was administered orally or intraperitoneally, the highest tissue concentration, 3.86% of the administered dose, was found in the fat. The mean cumulative percentages of the administered dose recovered after 5 days in urine were 2.63% and 1.86% respectively for oral and intraperitoneal routes; and in feces, 50.36 and 12.44% respectively. Negligible $^{14}CO_2$ was detected in respired air. Of five treatments tested (cold, fasting, norepinephrine, and pre- and post-DDT treatment with diphenylhydantoin), only the cold treatment produced a statistically significant increase in DDT elimination. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-21,160.)

73-1655. Bandy, L. W. (Ohio State Univ., Columbus, OH). **The bioaccumulation and translocation of ring-labeled chlorine-36 DDT in an old-field ecosystem.** *Diss. Abstr. Int. 33(2): 679B; 1972.*

The rates of accumulation and translocation of the insecticide DDT were measured in a central Ohio old-field ecosystem during the 1969 growing season using clay-formulated insecticide labeled in the ring position with the radioisotope chlorine-36. DDT levels in old-field biota were measured by liquid scintillation counting. The leaves of 10 herbaceous plant species carried DDT residues at one or more periods during the growing season. DDT vaporization from the soil followed by condensation on the plant surfaces is thought to be the mechanism of contamination. Highest DDT levels in vertebrates were found in the slug (seasonal mean 18.89 ppm). The highest vertebrate tissue and total body residues were detected in the short-tailed shrew, with a seasonal mean of 7.38 ppm. DDT was also detected in masked shrew, meadow vole, mink, cottontail rabbit, wood mouse, red-winged blackbird, ring-necked pheasant, and garter snake. Total body DDT storage patterns in shrew and vole were characterized by rapid accumulation during the first month, followed by stationary storage levels. A compartmentalization estimate indicated that 3% or less of the DDT initially applied to the old-field ecosystem was compartmentalized in the macrobiota during the growing season. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-20,940.)

73-1656. Dahlgren, R. B. (South Dakota State Univ., Brookings, SD). **Effects of polychlorinated biphenyls in the ring-necked pheasant.** *Diss. Abstr. Int. 33(3): 974B-975B; 1972.*

In 1970 and 1971 cock pheasants were given single capsules weekly containing 0 and 25 mg polychlorinated biphenyls, Aroclor 1254 (PCB), and hens were given 0, 12.5, and 50 mg. Egg production was reduced both years in hens given 50 mg PCB. Egg hatchability and embryo viability were impaired by PCB administration, but eggshell thickness was not affected. Chick survival was lower in PCB-treated groups. PCB in doses varying from 10 mg to 210 mg daily caused hyperexcitability, weakness, tremor, lack of appetite, lack of feathers, coma, and death. Heart and spleen weight were increased at all PCB levels, and kidney and liver weights were increased in birds given 10- and 20-mg doses daily, but not in birds given 210 mg. When PCB and dieldrin were given jointly, only additive, not synergistic, effects were noted. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-24,715.)

73-1657. Hannon, M. R. (South Dakota State Univ., Brookings, SD). **Distribution and physiological effects of DDT, DDD and DDE in penned double-crested cormorants (*Phalacrocorax a. auritus*).** *Diss. Abstr. Int. 33(3): 975B; 1972.*

Levels, distribution, and excretion of DDT, DDD (TDE), and DDE were determined in tissues of penned cormorants administered doses of 2, 5, and 10 mg of total DDT and metabolites (40 percent DDT, 30 percent DDD, and 30 percent DDE) daily in their diet. Carcass retention of total experimental dose was estimated at 32-54%; and 19-29% of the daily dose was lost in the excreta. DDE was present at highest concentrations in all sample types analyzed, followed by DDD; DDE was present in greater and DDT in lesser proportion than during treatment. Birds on reduced diet for two weeks after cessation of insecticide treatment had increased brain and decreased carcass residue concentrations. All birds diagnosed on the basis of tremors and convulsions as dying of insecticide toxicosis were females. Brain DDT concentrations were 1-24 ppm in survivors and 24-84 ppm in birds that died. Liver vitamin A and carotene levels were little affected by treatment. Treated birds showed significant difference from untreated birds in terms of liver and heart weights, but not brain or spleen weights. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-24,717.)

73-1658. Budreau, C. H. (University of Western Ontario, London, Ontario, Canada). **Teratogenicity and chronic toxicity of three organophosphorus insecticides in CF*1 mice.** *Diss. Abstr. Int. 33(3): 1174B; 1972.*

The transplacental passage, teratogenicity, embryotoxicity, and chronic toxicity of some organophosphorus insecticides were studied in CF*1 mice. Placental tissue was heavily labeled within 20 minutes after administration of ^{32}P demeton at 5 mg/kg on day 14 of gestation. Osteogenic mesenchyme, muscle, and liver were the main sites of radioactivity in the fetus. The compound appeared to be rapidly metabolized and eliminated since maternal or fetal tissues showed only trace activity after three hours. Demeton administered as a single dose of 7 or 10 mg/kg or as three consecutive doses of 5 mg/kg each between days 7 and 13 of gestation was embryotoxic with only mild teratogenic potential. Fenthion administered as a single dose of 20, 40, or 80 mg/kg or as three consecutive doses of 20 mg/kg each between days 6 and 13 of gestation resulted mainly in embryotoxic effects. In five-generation studies with administration of dimethoate and fenthion at 60 ppm in drinking water, mating success and reproduction period of mice were affected by treatment. Slight reductions in survival rate and growth rate of the young accounted for this difference. Abnormalities were rare with only a few cases of cleft palate being found among the fenthion treated young. Slight toxic effects on kidney and liver cells and reductions in erythrocyte cholinesterase were found at higher dosage levels in adults. (Author abstract by permission, abridged. Microfilm copies of the thesis are available from National Library of Canada at Ottawa.)

73-1659. Speidel, H. K. (Univ. Houston, Houston, TX). **Microbial removal of chlorinated hydrocarbon pesticides from water.** *Diss. Abstr. Int. 33(3): 1209B; 1972.*

The removal of chlorinated hydrocarbons from water by two systems of microorganisms was examined. One system was composed of three Gram-negative bacteria, the second contained these plus an additional organism. The organisms produced floc forming cultures which gave some evidence for partial degradation of pesticides by the identification of metabolic byproducts and production of increased biomass. One organism in each system contained small amounts of bacteriochlorophyll and functioned with carbon dioxide as the only carbon source under anaerobic conditions. Initial pesticide removal was accomplished by adsorption to floc material formed by the systems, by adsorption into the lipid material of the cells, and by a crystallization process carried out by certain cells. Flocculation was carried out by production of a polymeric carbohydrate material or by surface-charge adsorption. Optimal conditions for floc formation included shake culture; light; presence of heptachlor, yeast extract, and small amounts of magnesium; and pH 7-8. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-24,659.)

73-1660. Rice, C. P. (Cornell Univ., Ithaca, NY). **Degradation of DDT by selected fresh water algae.** *Diss. Abstr. Int. 33(4): 1427B; 1972.*

Each of ten algal species investigated (two green algae and eight blue-green algae) produced small amounts of DDE when incubated with DDT. The blue-greens were the most active converters. Cells were necessary for conversion; activity remained with the pellet in centrifuged cultures. Conversion practically ceased after about four days, and cell division also ceased by the fourth day of incubation. Addition of glutathione to *Anacystis nidulans* cultures did not result in increased conversion, eliminating the possibility that conversion might be a glutathione-limited DDT dehydrochlorinase-mediated reaction. Dark-grown cells did not convert DDT to DDE, and also failed to produce the pH increase from 8 to 10.5 seen with light-grown cells. Conversion was higher in cultures maintained at pH 10-10.5 than in those at pH 7-8. Conversion was low in a cell-free medium, even at high pH. No conversion was detected in solutions of various pH containing clay particles or glass or plastic beads as dispersers. Algal cells disrupted by sonication were more active converters than intact cells. Soluble fractions from disrupted cells were purified by dialysis and ammonium sulfate precipitation; one such fraction was approximately 50 times more active in converting DDT and DDE than whole cells.(Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-27,968.)

73-1661. Daniel, T. C. (Univ. of Wisconsin, Madison, WI). **I. Evaluation of diquat and endothall for the control of water milfoil (*Myriophyllum exalbescens*) and the effect of weedkill on the nitrogen and phosphorus status of a waterbody. II. Design and construction of a shallow water sediment core sampler.** *Diss. Abstr. Int. 33(4): 1598B; 1972.*

Aquatic herbicides (diquat and endothall) were evaluated in a field experiment in open ended plastic tanks (150 x 150 cm) in a small pond located near Milwaukee, Wisconsin. Both herbicides, alone or in combination, produced rapid weedkill; diquat was the more effective of the two. Diquat applications resulted in rapid release of plant cell contents, thereby allowing increases in the N and P fractions of the surface water. Corresponding decreases in dissolved oxygen and fishkill occurred. The effect of endothall was slower with release of cell contents occurring 24 days after treatment, at which time the surface water showed an increase in several fractions of phosphorus and depletion of dissolved oxygen status; no fishkill occurred. Although regrowth of water milfoil did not occur in any system where herbicide and/or algicide (Cu triethanolamine) had been applied the previous season, cyclic blooms of algae and invasion by pondweed were observed; in the untreated areas dense stands of water milfoil returned, slight algae growth was observed but no evidence of pondweed growth could be found. A novel shallow water core sampler was constructed from plumbing materials and extruded plexiglas tubing. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-22,083.)

73-1662. Fabacher, D. L. (Mississippi State Univ., State College, MS). **Tolerance to botanical insecticides and investigations into endrin resistance in mosquitofish (*Gambusia affinis*) Baird and Girard.** *Diss. Abstr. Int. 33(4): 1598B; 1972.*

Insecticide-susceptible and resistant mosquitofish (*Gambusia affinis*) were bioassayed with the botanical insecticides, rotenone and pyrethrum. Studies were also conducted to determine mechanisms of endrin resistance in mosquitofish. Resistant mosquitofish showed a 1.8-fold tolerance to rotenone and a 2.4-fold tolerance to pyrethrum over a susceptible strain. The 24-hr LC50 values for rotenone in susceptible and resistant mosquitofish were 17 and 31 ppb respectively. The 24-hr LC50 values for pyrethrum in susceptible and resistant mosquitofish were 27 and 93 ppb, respectively. Results with sesamex, an inhibitor of mixed-function oxidase (mfo) enzymes, indicated that rotenone tolerance in mosquitofish probably results entirely from increased levels of mfo enzymes. The tolerance to pyrethrum apparently involves other factor(s) in addition to mfo enzymes. The lipid content of resistant mosquitofish is about twice that of susceptible fish. Susceptible mosquitofish that survived exposure to endrin consistently contained more lipid than dead fish at the intervals and concentrations tested. Additional factors that may contribute to endrin resistance include a greater uptake of endrin by susceptible fish, a more efficient blood-brain barrier in resistant fish, and a low degree of binding by endrin to sensitive areas of nervous tissue in resistant fish. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 72-25,974.)

73-1663. Silbergeld, E. K. (The Johns Hopkins Univ., Baltimore, MD). **Effects of organochlorine insecticide exposure on adaptation to thermal stress in the johnny darter, *Etheostoma nigrum* Rafinesque.** *Diss. Abstr. Int. 33(4): 1601B; 1972.*

Exposure to the organochlorine insecticide dieldrin was shown to affect the ability of a freshwater fish to adapt to thermal change. Johnny darters, *Etheostoma nigrum* Rafinesque, were exposed to sublethal concentrations of dieldrin for 30 days during which time growth rates, mortality, blood glucose, insecticide content, lipid content, opercular movements, oxygen consumption, feeding rates, and liver conditions were monitored in exposed and control fish. On day 31, fish were subjected to increases in water temperature at a rate of one degree centigrade every eight hours to a maximum of 24 degrees Centigrade. Under the conditions of thermal stress, fish exposed to dieldrin died; unexposed fish survived. A hypothesis was developed that dieldrin altered metabolic functions and

function relationships, so that further stress from thermal change caused death. All parameters measured during the first 30 days of the experiment changed significantly during the first 15 days. After day 15, the fish adjusted to insecticide exposure. A new equilibrium of physiological functions was established, which differed from controls measured at the same time. A model is proposed, based on adrenal-pituitary-glucocorticoid response to stress. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 72-24,995.)

73-1664. Stevens, J. T. (West Virginia Univ., Morgantown, WV). **The effects of anticholinesterase insecticides on hepatic microsomal metabolism.** *Diss. Abstr. Int. 33(4): 1707B-1708B; 1972.*

Acute administration of parathion, paraoxon, malathion, disulfoton, and carbaryl prolonged hexobarbital sleeping time in the mouse and inhibited the metabolism of hexobarbital in vitro. OMPA (schradan) had no effect on either parameter. The increase in duration of hexobarbital sleeping time was apparently not related to inhibition of cholinesterase or to altered sensitivity of the brain to the barbiturate. The effect on hexobarbital sleeping time was related only to the impairment of hexobarbital metabolism since only those insecticides which inhibited hexobarbital oxidation in vitro could prolong sleeping times. Except for OMPA, the insecticides also depressed the microsomal metabolism of aniline and hexobarbital in the mouse. Paraoxon enhanced rather than inhibited aniline hydroxylase activity in the mouse, rat, rabbit, and dog. Malathion and carbaryl inhibited hexobarbital and aniline metabolism in all species examined whereas OMPA had relatively little effect on the rate of drug metabolism. Carbaryl toxicity was potentiated by pretreatment of mice with either tolbutamide or bishydroxycoumarin. Paraoxon added to microsomal preparations at concentrations above $2 \times 10^{-5} M$ enhanced the *para*-hydroxylation of aniline. A major metabolite of paraoxon, *p*-nitrophenol, also has some enhancing properties. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-26,894.)

73-1665. North, H. H. (Univ. of Maryland, College Park, MD). **Pesticide metabolism in mammalian cell cultures.** *Diss. Abstr. Int. 33(5): 2135B; 1972.*

A system has been developed wherein cultures of primary human embryonic lung cells are utilized to study pesticide degradation. Degradation can be stopped at any desired interval for analysis of pesticide metabolites. Dimethoate was oxidatively metabolized in this system in a sequence similar to that found in rats. However, oxidative metabolism of dimethoate predominated over hydrolytic metabolism in the tissue culture system while the reverse was true in rats. Dicrotophos and phosphamidon were very resistant to metabolism in the cultures. Tissue culture metabolism of DDT occurred by reductive dechlorination to DDT, with subsequent formation of DDA. This pathway is quite similar to that seen in mammals and microorganisms. Carbaryl was metabolized primarily by hydrolysis to 1-naphthol. Evidence for conjugation of some carbaryl metabolites was found, analogous to in vivo results. Chlorphenamidine was metabolized to 4-chloro-*o*-toluidine in a manner similar to that in microorganisms. Chlortoluron was fairly resistant to metabolism in tissue cultures, but yielded small quantities of previously undetected metabolites. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-29,413.)

73-1666. Koeferl, M. T. (Oregon State Univ., Corvallis, OR). **Potentiation of acute carbon tetrachloride hepatotoxicity by dietary exposure to chlorophenothane (DDT) in rats.** *Diss. Abstr. Int. 33(5): 2245B-2246B; 1972.*

Effects of chronic and acute pretreatment with DDT on acute carbon tetrachloride toxicity were compared. Rats fed DDT at concentrations of 6-65 ppm for 3 wk and 45 ppm for 24 wk attained body burdens of DDT and its metabolites ranging from 6.1 to 30.6 ppm. These treatments or administration of 35-150 mg/kg DDT by gavage 24 hr prior to administration of carbon tetrachloride at 0.125-1.0 ml/kg increased the subsequent rise in SGOT and SGPT activities in a dose-dependent manner. Liver damage was confirmed by observation of histopathological abnormalities and elevated bromsulfalein retention. The potentiation of damage by carbon tetrachloride was prevented by spinal cord transection at the level of the seventh cervical vertebra. About 75% of the induced cytochrome P-450 concentration in the DDT-fed rats was destroyed within 6 hr after carbon tetrachloride, at which time the onset of potentiated hepatic damage was detected. The carbon tetrachloride-induced increase in liver weight was greater in controls than in DDT-pretreated animals. Lead significantly reduced the effect of prior DDT feeding in potentiating carbon tetrachloride-induced hepatotoxicity. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-27,632.)

73-1667. Goswami, K. P. (Univ. of Hawaii, Honolulu, HI). **Fate of ametryne in soil, nutrient solution-sugarcane and soil-sugarcane systems.** *Diss. Abstr. Int. 33(6): 2436-2437; 1972.*

A study was carried out using ring-^{14}C-ametryne to determine its degradation and metabolism. In a nutrient solution-sugarcane system, sugarcane roots rapidly converted ametryne to more polar compounds (90% at 3 days); the major degradation products were dealkylated ametryne (32.9%) at 20 days, and 2-methyl-

thio-4,6-diamino-*s*-triazine (12.5%) and ammeline (34.4%) at 30 days. Of the absorbed ^{14}C, 1.7% > 8.0% and > 23.0% $^{14}CO_2$ were evolved respectively from ring-^{14}C ametryne, ring-^{14}C hydroxyatrazine, and ethyl-^{14}C-hydroxyatrazine treated plants. A volatile ^{14}C metabolite, not carbon dioxide but a basic, water soluble compound, was discovered in condensed transpired water from ametryne treated sugarcane. Ametryne and hydroxyatrazine were degraded through different mechanisms in sugarcane. Ametryne degradation in bare soil was primarily a microbial process (*N*-dealkylation) with limited simultaneous chemical hydrolysis. Sugarcane roots accelerated ametryne degradation by several fold in nutrient solution (*N*-dealkylation) and in soil (2-hydroxylation). In non-sterilized Hilo and Molokai soils, 36 and 25% respectively of ametryne was converted to polar metabolites in 60 days. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-31,054).

73-1668. Starr, R. I. (Univ. of Wyoming, Laramie, WY). **The absorption, translocation, and metabolism of ^{14}C-4-aminopyridine in corn and sorghum: its movement and degradation in soil systems.** *Diss. Abstr. Int. 33(6): 2443B-2444B; 1972.*

No detectable acetone-soluble metabolites were present in corn plants cultured for 1 week in solutions of radiolabeled 4-aminopyridine. However, autoradiograms of TLC plates containing acetone extracts of treated sorghum showed that some degradation of ^{14}C-4-aminopyridine had occurred within both shoots and roots of 1-month plants within a 2-week period, with metabolites similar in both tissues. Acetone extraction removed 99.5% of the radioactivity from sorghum shoots cultured 1 hour to 7 days in 5 ppm ^{14}C-4-aminopyridine, with 80.7% removed from tops grown for longer periods (8 to 14 days), suggesting that some of the chemical was bound by cellular components. Adsorption of 4-aminopyridine to soils was related to soil pH, with residues being more tenaciously held to acidic soils than to ones of alkaline reaction. Results of soil metabolism studies showed aerobic conditions were necessary for degradation of the chemical, which began 1 week after application. Under optimal conditions, 42 to 60% of the parent compound was degraded to radiolabeled carbon dioxide during a 2-month incubation period. Although only small quantities of radiolabeled materials were extracted with acetone from 3-month-incubated soil (0.5 to 11.2%), autoradiograms prepared from TLC plates containing aliquots of these extracts revealed trace amounts of two metabolites. (Author abatract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-32,799).

73-1669. Varela-Alvarez, H. (The Pennsylvania State Univ., College Park, PA). **Certain physiological factors affecting organochlorine pesticide metabolism in ovines.** *Diss. Abstr. Int. 33(7): 2871B; 1972.*

Ewes were given DDT and dieldrin (50 mg/kg body weight) then bred. Fat and milk samples from ewes and whole-carcass samples from lambs were taken immediately after lambing and 5 and 10 weeks later. Pregnancy did not affect total DDT degradation, but retarded dieldrin metabolism. Lactation greatly accelerated pesticide disappearance from the body. The concentration of DDT metabolites in milk fat was proportional to total DDT in body fat although a similar correlation did not hold for dieldrin. Of the total DDT in ewe body fat, 64% was stored in the form of DDE, 11% as DDD (TDE), and 25% as DDT. Placental transfer of DDT, its metabolites, and dieldrin resulted in contamination of all newborn lambs. Continued pesticide ingestion via ewes' milk in suckling lambs was counterbalanced by constant pesticide metabolism. Female suckling lambs stored significantly more DDT and DDT metabolites than did males, but dieldrin storage was the reverse. According to the results obtained, lambs contaminated in utero with DDT and dieldrin at 50 mg/kg will not contain legally excessive residues at slaughter. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-33,214.)

73-1670. Keffler, L. R. (Univ. of Mississippi, State College, MS). **A study of the influence of calcium on the effects of DDT on fishes.** *Diss. Abstr. Int. 33(7): 2946B-2947B; 1973.*

Investigations were undertaken dealing with a likelihood of a relationship between calcium deficiency and DDT poisoning. Goldfish, *Carassius auratus* (Linnaeus), and golden shiners, *Notemigonus chrysoleucas* (Mitchell), were tested using sixteen different combinations of calcium and DDT concentrations. Because of the possibility of influence by the accompanying anion, three different salts were used as sources of the calcium ion. A series of different experimental tests indicated good probability of the suspected relationship between calcium and DDT. It is known that calcium deficiency upsets the proper functioning of nerves, leading to twitching, convulsions, tetany, and even death. Calcium deficiency is also expressed in loosening of the binding between cells, in loss of blood retention ability by capillary walls and in loss of control of melanophore function. Fishes poisoned with DDT in the laboratory were observed to give evidence of all these symptoms of calcium deficiency. Increasing the concentration of calcium ions in the water from 0 to 200 ppm seemed to alleviate the DDT poisoning symptoms of fishes and decrease the death rate when the DDT concentration did not exceed 20 ppb. Goldfish, *Carassius auratus*, were more responsive to treatment than were golden shiners, *Notemigonus chrysoleucas*. Of the calcium salts used calcium chloride was more effective than either calcium carbonate or calcium gluconate. Two possible con-

clusions to be drawn are that DDT is not simply a neurotoxin, and that the calcium differences between hard and soft water may be sufficient to give a survival advantage to fishes in the hard water regions of the country. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 73-1275.)

73-1671. Gibson, W. L. (Mississippi State Univ., State College, MS). **Microbial degradation of parathion.** *Diss. Abstr. Int. 33(7): 3213B; 1973.*

An organism capable of utilizing parathion as its sole carbon and energy source was isolated by enrichment culture techniques and tentatively identified as *Pseudomonas aeruginosa*. A pH of 7.0-7.5 and a temperature of 30°C were optimal for parathion consumption. Virtually no oxygen utilization was observed with resting cell suspensions when nonsolubilized parathion was employed. The use of ethanol as the solvent for parathion or preincubation of cells in ethanol obviated this problem, apparently due to stripping off of cell wall or capsule components by parathion. Approximately 80% of the parathion consumed by resting cells was present terminally as carbon dioxide. Enhanced parathion utilization was seen in cells grown in a carbon dioxide-enriched atmosphere. The isolate was also capable of growth on paraoxon, *p*-nitrophenol, *p*-aminophenol, and phenol, which lie in the proposed pathway of parathion degradation, terminating in the formation of carbon dioxide and water. Thunberg investigations indicated that an oxygenase was responsible for a portion of the attack on the parathion molecule by this pseudomonad. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-168.)

73-1672. Verschuuren, H. G. (Rijks Inst. voor de Volksgezondheid, Utrecht, The Netherlands.) **Moderne Gesichtspunkte der toxikologischen Beurteilung von Pestiziden. [Modern aspects of the toxicological assessment of pesticides.]** *Ernaehrungsforschung 16(4): 493-501; 1971.* (10 references) (German)

Modern aspects of the toxicological assessment of pesticides are reviewed with special regard to the acceptable daily intakes, no-toxic effect level, and safety factors. The acetylcholinesterase activity and plasma cholinesterase activity inhibition, considered significant at the 20 to 30% level, is a good indicator of pesticide intake. Certain doses of toxic substances increase the activity of the hepatic microsomal enzymes and hasten the metabolism of the toxic substance. Metabolism may result in increased toxicity as in the case of parathion. Organochlorine pesticides are hepatotoxic; DDT is assumed carcinogenic; teratogenic effects, if any, of pesticides are dose-dependent. Extrapolation of toxicological data from animal tests requires safety factors to account for differences in susceptibility to pesticides between humans and animals. The safety factor is set at 100 in most cases and 10 for several organophosphorus pesticides.

73-1673. Kagan, Yu. S. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastic Materials, Kiev, USSR). **Aktuelle Fragen der Toxikologie phosphororganischer Insektizide. [Current problems of the toxicology of organophosphorus insecticides.]** *Ernaehrungsforschung 16(4): 503-514; 1971.* (33 references) (German)

The current state of organophosphorus insecticide toxicology studies is reviewed. Animal tests determined hepatic damages due to DDVP; kidney damages due to methylacetoxon and phthalophos (phosmet); increased blood clotting ability due to DDVP and methylnitrophos (fenitrothion); embryotoxic effect of phthalophos; and toxic effects of DDVP and phencapton on the hypophyseal system and the adrenal cortex. Cholinesterase activity inhibition is a common feature of organophosphorus pesticides. These findings indicate varying degrees of selective organotropy, independent of the rate of cholinesterase inhibition, which may be due to differences in the reaction rates of organophosphorus compounds and detoxifying enzymes. Dipyroxime, especially in combination with atropine, complexes of cobalt with monoethanolamine, some sulfur-containing hydroximic acids and oximes, and *S*-aminoethylesters of thiohydroximic acids are adequate cholinesterase reactivators. The use of highly toxic organophosphorus pesticides such as systox (demeton), methylethyl parathion, and parathion has been prohibited in the USSR.

73-1674. Lohs, Kh.; Gibel, W. (Forschungsstelle fuer chem. Toxikol., Akad. der Wissenschaften der DDR, Leipzig, DDR). **Ueber die hepatotoxische und cancerogene Wirkung des Trichlorphon. [On the hepatotoxic and carcinogenic action of trichlorfon.]** *Ernaehrungsforschung 16(4): 515-517; 1971.* (3 references) (German)

Hepatotoxic and carcinogenic effects of trichlorfon were studied on male and female Wistar rats and mice. Wistar rats were administered three 30 mg/kg doses s.c. or through gastric tube weekly; skin application of identical doses of trichlorfon with or without croton oil was used for mice. Hepatic damages of varying degrees, such as central necrosis, hyperemia, hemorrhage, and typical postnecrotic cirrhosis were observed six months after the start. One case of hepatic carcinoma after 17 months of cutaneous application, and another case of soft-tissue sarcoma following application of trichlorfon plus croton oil over 14 months developed. When applied s.c., trichlorfon failed to induce local tumors. Exophytic papillomas due to s.c. and orally applied trichlorfon were found in the rat forestomach. The premature death of several animals may have reduced the rate of tumor incidence. Carcinogenesis

hazards due to the ingestion of trichlorfon-contaminated food by humans seems unlikely.

73-1675. Polster, M.; Halacka, K. (Inst. Hyg., Purkyne Univ., Brno, Czechoslovakia). **Beitrag zur hygienisch-toxikologischen Problematik einiger antimikrobiell gebrauchter Organozinnverbindungen. [Contribution to the hygienic and toxicological study of some organotin microbicides.]** *Ernaehrungsforschung 16(4): 527-535; 1971.* (26 references) (German)

Microbicidal activity of bis-tributyltin oxide, tributyltin acetate, tributyltin oleate, tributyltin benzoate, tributyltin chloride, tributyltin laurate, and triphenyltin acetate for different species of bacteria, yeasts, and molds, and toxicity of such compounds in warm-blooded and cold-blooded organisms and algae were studied. The acute oral LD50 values determined for warm-blooded animals such as mice ranged from 46 to 230 mg/kg body weight with slight mucous and dermal toxicity determined in rabbits and rats. The LD50 values ranged from 0.001 to 0.1 ppm for aquatic microorganisms such as *Lebistes reticulatus, Daphnia magna* and *Tubifex tubifex*. Tributyltin compounds, highly toxic to fish, are indicative of the problems of contamination of water with organotin compounds. A maximum allowable tributyltin compound concentration of 3 μg/l. is recommended for waste waters. Small quantities of tributyltin compounds in water can be determined by a photometric method using dithizone following extraction with pure chloroform.

73-1676. Heinisch, E.; Reifenstein, H. (Inst. f. Pflanzenschutzforschung, Akad. der Landwirtschaftswiss. der DDR, Kleinmachnow, DDR). **Herbizidrueckstaende in Lebensmitteln pflanzlicher Herkunft. [Herbicide residues in foods of vegetable origin.]** *Ernaehrungsforschung 16(4): 605-615; 1971.* (11 references) (German)

Studies on the toxicology of herbicides and herbicide residue determination in vegetable foods are reviewed. The oral LD50 values determined for DNOC, dinoseb, paraquat, ioxynil, diquat, chlorophenoxyalkanoic acids, barban, chlorthiamid, chloralhydrate, chlorate, proximpham, triallate, dichlobenil, desmetryne, prometryne, maleic acid hydrazide, metobromuron, atrazine, diuron, simazine, chlorpropham, fenuron, dalapon, and amitrole in rat are 18-85, 25-50, 110-200, 110-305, 200-300, 375, 600-1350, 750-1000, 1080, 1200, 1540, 1560, 1500-4500, 1390, 2150-3750, 2350, 2700-3000, 3080, 3400-3600, 5000, 5000-7500, 6400-7500, 7570-9330, and 25000 mg/kg. Considerable increase in the rate of metabolism in rabbit due to DNOC, teratogenic effect of 2,3,6,7-tetrachlorodibenzodioxin in dog, and proliferative processes in rats fed more than 100 ppm of amitrole over more than two years were determined. Sarcoma was induced experimentally in rats by s.c. administration of 670-2,500 mg of maleic acid hydrazide while no tumor following intake of 10,000 ppm was observed. Carrots harvested 3-5 months after treatment with 2.5 kg of prometryne per ha contained 0.02-0.05 ppm of prometryne.

73-1677. Van den Bercken, J.; Akkermans, L. M. A.; Van Langen, R. G. (Inst. Vet. Pharmacol. Toxicol., Univ. Utrecht, Utrecht, The Netherlands). **The effect of DDT and dieldrin on skeletal muscle fibres.** *Eur. J. Pharmacol. 21(1): 89-94; 1973.* (13 references)

Skeletal muscle fibres from DDT–poisoned toads had marked increases in the amplitude of the negative afterpotential and in the duration of the action potential. DDT had no appreciable effect on the decay time of the negative after potential or on the resting potential. Fibers from muscles soaked in Ringer solution containing $5 \times 10^{-4} M$ DDT yielded similar results. Muscles from dieldrin-treated animals were in poor condition due to intense muscular activity and results were discarded. In vitro exposure to $5 \times 10^{-4} M$ dieldrin for one hour had no effect on the negative afterpotential and resting potential. A marked increase in magnitude of the negative afterpotential was observed at two or three hours of exposure. Time course of decay of the negative afterpotential and resting potential were not affected. The action potential was prolonged after one hour exposure. The increase in the duration of the action potential could be responsible in part for the effects of both insecticides on the mechanical response of skeletal muscle. Repetitive activity that could be attributed to DDT or dieldrin was not observed in the in vitro or in vivo experiments.

73-1678. Van den Bercken, J.; Akkermans, L. M. A.; Van der Zalm, J. M. (Inst. Vet. Pharmacol. Toxicol., Univ. Utrecht, Biltstraat 172, Utrecht, The Netherlands). **DDT-like action of allethrin in the sensory nervous system of *Xenopus laevis*.** *Eur. J. Pharmacol. 21(1): 95-106; 1973.* (31 references)

Lateral-line organs of clawed toads which had been exposed to DDT concentrations from 2 to 4 ppm for 18 hr showed a pronounced repetitive activity, and all nerve impulses were grouped together in trains of spikes. A decrease in temperature increased the average number of repetitive spikes per train. Application of DDT to the solution bathing the isolated organ had no effect. Allethrin, which was highly toxic to the toad produced repetitive activity both in vivo and in vitro. The same reversible temperature effect was observed with allethrin, and the action of allethrin showed a negative temperature coefficient, measured by the number of spikes per train similar to that following treatment with DDT. Sensitivity to mechanical stimulation was reduced by DDT treatment, probably because of the slime secretion produced, and was not greatly altered by allethrin exposure in vitro in which no slime secretion was produced. Similar repetitive activity was observed in

a sensory branch of sciatic nerve, but not a motor branch with both insecticides. The repetitive activity did not originate in the afferent nerve fibers as such and required an intact sense organ. The dimethylcyclopropane group of allethrin could be responsible for its DDT-like activity.

73-1679. Woodin, A. M.; Harris, A. (Strangeways Res. Lab., Worts Causeway, Cambridge, England). **The inhibition of locomotion of the polymorphonuclear leucocyte by organophosphorus compounds.** *Exp. Cell Res. 77(1-2): 41-46; 1973.* (8 references)

After exposure to DFP and other organophosphates, the locomotion of rabbit polymorphonuclear leucocytes was inhibited in vitro using time-lapse cinemicrography. The proportion of cells undergoing no net locomotion increased and the speed of those cells which moved decreased with both phosphorylating and nonphosphorylating compounds. DFP, DIP (triisopropylphosphate) and DEP (diisopropylethyl phosphate) were approximately equal in activity over the range of 0.5 to 8 m*M*. The effect was reversible at low concentrations but persisted with higher concentrations. It is possible that the supposed effect of organophosphorus compounds on chemotaxis may be due to the inhibition of locomotion per se, probably through detergent properties rather than enzyme inhibitory activity.

73-1680. Dikshith, T. S. S.; Datta, K. K. (Ind. Toxicol. Res. Cent., Lucknow, India). **Pathologic changes induced by pesticides in the testes and liver of rats.** *Exp. Pathol. 7(5-6): 309-316; 1972.* (9 references)

Treatment of rats with ethyl parathion or methyl parathion plus DDT at a dose equivalent to the lowest dilution used during spraying damaged the seminiferous tubules and the liver. Over the 90 day observation period, necrosis, karyopycnosis, vacuolation of the cytoplasm, and formation of multinucleate giant cells were noted in the spermatogenic cells. Characteristic cellular lesions in the liver included cytoplasmic margination coupled with cellular hypertrophy and feathery degeneration of the cytoplasm. Ethyl parathion produced severe effects by the 90th day in liver while changes were partially restored by that time with methyl parathion plus DDT. Clinical signs of poisoning by any of the insecticides were not observed, and testes and liver weights did not differ significantly from those of the controls.

73-1681. Hendrickson, C. M.; Bowden, J. A. (Dept. of Biochem., Louisiana State Univ., Baton Rouge, LA 70803). **The in vitro inhibition of lactic dehydrogenase by selected polychlorinated pesticides.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 235; 1973.*

Since little is known about the in vitro effects of pesticides and related compounds on energy metabolism, a series of experiments was devised using rabbit muscle lactic dehydrogenase (IUB 1.1.1.27) (LDH), the terminal enzyme of anaerobic glycolysis, as a model system. Selected compounds dieldrin (D), endrin (E), aldrin (A), DDT isomers, mirex (M), lindane, malathion, Dursban (chlorpyrifos), methyl parathion, carbamate herbicides, and a polychlorinated biphenyl were assayed for inhibitory effects on LDH at 340 nm in 0.1 *M* phosphate (10% ethanol) at pH 7.5, pyruvate at 6.6×10^{-4} and 1.3×10^{-3} M, and DPNH at 7.0×10^{-5} *M*. D, A, E, M, *o,p'*-DDT and *p,p'*-DDT inhibited LDH at the range 10^{-6}-10^{-5} *M*. Dixon plots indicate that all are competitive inhibitors (*Ki* values 1×10^{-5}-6×10^{-5} *M*). Among dieldrin isomers the position of the epoxide function has no effect (D,E) but its removal (A) lowers the inhibition. Of the DDT isomers *o,p'*-DDT is more inhibitory; DDT analogs 1,1-diphenylethane and chlorobenzene have no effects, indicating that intramolecular proximity of chlorines may be a factor. Although M has highest percent chlorine, its *Ki* remains in the same range. It appears from this data that the polychloro functions common to these compounds play an important part in LDH inhibition; whether this competitive inhibition is specific for the selected group of compounds or is more generalized is not yet known. (Abstract number 132, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1682. Bickers, D. R.; Kappas, A.; Alvares, A. P. (N.Y.U. and Rockefeller Univ., New York, NY). **Effects of chlorinated hydrocarbons applied to skin on hepatic cytochrome P-450 and drug metabolizing enzymes.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 235; 1973.*

DDT and polychlorinated biphenyls (PCB) were applied (25mg/kg/day X6) to rat skin to determine their comparative effects on the hepatic mixed function oxidase system (MFOS) following percutaneous absorption. DDT treatment produced a less than 2-fold induction of cytochrome P-450 with a CO difference spectrum peak at 450 nm. The ethyl isocyanide difference spectrum showed peaks at 455 nm and 430 nm with a 455:430 ratio of 0.78. PCB caused a 3-4 fold induction of a cytochrome showing a CO-difference spectrum peak at 448 nm. The ethyl isocyanide complex of this cytochrome showed a shift of the 455nm peak to 453nm and an increase of the 453:430 ratio to 1.6; these are similar to the effects induced by skin application of the polycyclic hydrocarbon dimethylbenzanthracene. Application of DDT or PCB to skin led to enhanced activities of ethylmorphine *N*-demethylation and aniline hydroxylation in liver microsomes. PCB caused an increase in liver weight and microsomal protein while DDT did not. PCB also caused a marked increase in benzpyrene hydroxylase activity in skin and liver. Following a single application of DDT or PCB to skin there were similar though lesser effects on the hepatic MFOS. Peak responses evoked by both compounds were seen at four days; however the PCB effects

were greater and persisted for four weeks whereas those produced by DDT lasted only 8-10 days. (Abstract number 136, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1683. Nelson, J. A. (Kettering-Meyer Lab., Southern Res. Inst., Birmingham, AL 35205). **Effects of DDT analogs and polychlorinated biphenyl (PCB) mixtures on ^{3}H-estradiol binding to rat uterine receptor.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 236; 1973.*

Indirect evidence in vivo suggests that *o,p'*-DDT possesses estrogenic activity by virtue of its affinity for the rat uterine protein which specifically binds ^{3}H-estradiol (Cecil et al., *J. Agr. Food Chem.* 19: 61, 1971; Welch et al., *Toxicol. Appl. Pharmacol.* 14: 358, 1969). The inhibition of ^{3}H-estradiol binding to the rat uterine receptor in vitro produced by this agent and seven other DDT analogs is positively correlated with estrogenic activity in vivo. The table shows % inhibition of binding produced by some of these compounds at a concentration of 1 ppm. The *o,p'* isomers are significantly better inhibitors of binding than the corresponding *p,p'*-isomers: *o,p'*-DDT 50, *o,p'*-DDE 32, *o,p'*-DDD 33, *p,p'*-DDE 4, *p,p'*-DDE 11, *p,p'*-DDD (TDE) 3. Incubation of these agents with rat liver microsomes in the presence of TPNH did not alter the results shown, which also suggests that metabolic transformation is not necessary for estrogenic activity. On the other hand, purified methoxychlor appears to require activation to estrogenic metabolites(s). No correlation between estrogenic activity and inhibition of binding was observed for the PCB mixtures, Arochlor 1221 and 1254. In all cases the order of activity of these agents is only about 1/10,000 that of diethylstilbestrol. (Abstract number of 137, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1684. Norback, D. H.; Engblom, J. F. (Dept. of Pathol. and Primate Res. Cent., Univ. of Wisconsin, Madison, WI 53706). **Chlorinated dibenzo-*p*-dioxin distribution with rat tissues and subfractions of the liver.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 236; 1973.*

One hundred μg of Cl^{36}-octachlorodibenzo-*p*-dioxin were administered to male rats by gastric intubation daily for 21 days. Digested samples of urine, feces, selected organs, and subcellular hepatic fractions were analyzed for radioactivity with a liquid scintillation counter. Ninety-five percent of the daily dose was recovered in the feces and over 4% was present in the urine. After 21 days less than 0.3% of the total administered dose was detected in the total rat tissues. The liver contained the highest concentration per unit weight with adipose tissue containing concentrations 1/3 as great as that present in the hepatic tissue. Significant levels of radioactivity were found in the kidneys, heart, reproductive organs, skeletal muscle, skin, and serum. The greatest reservoirs of the compound per organ were the liver and skin. Over 95% of the radioactivity within the liver was associated with the microsomes with equal distribution within the rough and smooth fractions. Radioactivity of the urine was confined to the lipid soluble portion. Distribution of the radioactivity within rats that subsequently received a control diet for seven weeks was confined to the liver, adipose tissue, and skin at levels of approximately 20% that present in the tissues of rats following 21 days of uninterrupted ingestion. (Abstract number 138, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1685. Cody, M. M.; Iturrian, R.; Caster, W. O. (Dept. of Home Economics Nutrition, Univ. of Georgia, Athens, GA 30601). **Effect of fatty acids in the maternal diet on body fat and blood pressure responses in rats fed chronic low levels of DDT.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 236; 1973.*

During lactation and the latter half of pregnancy, 31 rats were fed diets containing 59% wheat starch-sucrose, 16% milk protein, Cuthbertson vitamin mixture, Williams-Briggs mineral mixture, and 16% of a mixed triglyceride supplement whose content of palmitate, stearate, oleate, and linoleate was determined by the requirements of the factorial experimental design. Offspring were weaned on a diet with similar components except for 20% milk protein and lipid consisting of 2% safflower oil. Diets contained either 5 or 25 ppm DDT. After 30 days there were differences in carcass lipid content and in blood pressure that were systematically related to: DDT level, fatty acid in maternal diet, and both. Body weight and carcass fat of the young were maximal when the maternal diet contained 16% of its calories as oleate. DDT at 25 ppm increased carcass fat for rats whose mothers received low levels (2.6% of calories) of linoleate. Blood pressure was maximal when maternal diets contained 8% of calories as linoleate and 12% of calories as stearate. DDT at 25 ppm increased blood pressure for rats whose mothers received high (14% of calories) or low levels of linoleate and/or 7.4% of calories as stearate. (Abstract number 139, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1686. Civen, M.; Brown, C. B.* (Dept. of Physiol., Coll. of Med., Univ. of California, Irvine, CA 92664). **Insecticide inhibition of steroidogenesis in isolated adrenal cells.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 244; 1973.*

The effects of the organophosphorus insecticide, 2,2-dichlorovinyl dimethyl phosphate (DDVP, dichlorvos) were studied on corticosterone (B) formation in isolated adrenal cells incubated in vitro. Isolated adrenal cells were prepared by collagenase dissociation of rat adrenals. The cells, 2×10^5 per incubate, were incubated in Krebs Ringer bicarbonate glucose, 4% BSA,

7.5mM Ca under 95% 0_2/5% CO_2 at 37 C. Corticosteroidogenesis was stimulated by the addition of either adenosine 3′,5′ cyclic monophosphate (CAMP) at a concentration of $10^{-5}M$ or Cortrosyn (synthetic α 1-25 ACTH) at a level of 1 ng/ml of incubate. Cells stimulated by CAMP produced 1.75 μg B/incubate/2 hr. Addition of $10^{-5}M$ DDVP to the incubate resulted in a 53% inhibition of stimulated B production. $10^{-7}M$ DDVP was not inhibitory. Cortrosyn stimulated cells produced 1.33 μgB/incubate/2 hr. DDVP at $10^{-5}M$ and $10^{-7}M$ inhibited Cortrosyn stimulation of B production 68% and 64%, respectively. These results indicate that at $10^{-7}M$ DDVP the primary site of inhibition is either at the ACTH molecule itself or its cellular binding site. At $10^{-5}M$, an additional point of inhibition is observed. This probably occurs either at the level of intracellular CAMP metabolism or at some point in the corticosterone biosynthetic pathway. (Abstract number 182, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1687. Reiter, L.; Talens, G.; Wooley, D. (Dept. of Environmental Toxicol. and Animal Physiol., Univ. of California, Davis, CA 95616). **Effects of parathion administration on cholinesterase activities and visual discrimination in monkeys.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 250; 1973.*

Parathion was administered orally to rhesus (*Macaca mulatta*) and bonnet (*M. radiata*) monkeys in doses ranging from 0.5-2.0 mg/kg.Cholinesterase activities of blood were determined colorimetrically. Three rhesus monkeys were conditioned on a visual discrimination task similar to that described by Pribram (*Sci. Amer.* 220, 73, 1969), except that patterns were generated by a 3X3 array of squares. Four discrimination problems were employed and each problem was presented 20 times (80 responses per session). Results indicate that peak inhibition of true cholinesterase (AChE) occurred 5-6 hr after parathion administration and was 25, 39 and 58% for doses of 0.5, 1.0 and 2.0 mg/kg, respectively. Recovery was complete within 2 weeks. Visual discrimination performance was measured at 2, 5, and 24 hr following parathion and at daily intervals until recovery. A dose of 0.5 mg/kg parathion had no effect on performance. Higher doses (1.0-2.0 mg/kg) disrupted performance; all animals refused to perform when tested 5 hr after parathion administration. Occasionally they elicited a few incorrect responses and then refused to work. The duration of this effect was related to the dose. In one monkey receiving a dose of 2 mg/kg, performance of one problem remained below the 80% criteria for almost 3 weeks. Results indicate that visual discrimination performance is disrupted by parathion and that the maximum effect coincides with peak inhibition of AChE. (Abstract number 213, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1688. Disney, G. W.; Verma, R. S.; Smith, J. T. (Nutrition Dept. Univ. of Tennessee, Knoxville, TN 37916). **Alterations in sulfolipid metabolism in malathion stressed rats.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 250; 1973.*

A previous investigation of $^{35}SO_4^{2-}$ incorporation into sulfolipid, mucopolysaccharide, nucleotide and sulfate transfer fraction from rat liver lipoprotein demonstrated a specific effect of malathion stress on sulfolipid metabolism. The liver lipoprotein sulfolipid from malathion-stressed rats fed 250 mg malathion per kg of rat had a specific activity significantly greater than controls. Recent data from the determination of total galactose, sulfate, and ^{35}S-activity in liver lipoprotein sulfolipid prepared from nuclei, mitochondria, and the residue indicates that nuclear sulfolipid is the cellular component most active in $^{35}SO_4^{2-}$ incorporation. A decreased sulfate:galactose molar ratio in all three fractions indicated that sulfate was being mobilized from sulfolipid during malathion stress and was replaced with labeled sulfate. Further evidence for the mobilization of sulfolipid sulfate was provided by the finding of a statistically significant increase in arylsulfatase activity per mg N in liver homogenates of malathion-stressed rats as compared with controls. In brain sulfolipid, malathion stress caused a decreased $^{35}SO_4^{2-}$ incorporation and an increased sulfate:galactose molar ratio. Since the galactose measured came from both sulfolipid and cerebrosides, the increased sulfate:galactose molar ratio suggests demyelination caused by malathion stress. (Abstract number 214, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1689. Rumsey, T. S.; Bond, J.; Daniels, F. L. (U.S. Dept. of Agr., Agr. Res. Service, Nutr. Inst., Ruminant Nutr. Lab., Beltsville, MD 20705). **Studies on placental transfer of ruelene and its effect on bovine fetuses.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 250; 1973.*

Ruelene (4-tert-butyl-2-chlorophenyl methyl methylphosphoramidate), a systemic organic phosphate insecticide, is used extensively to control grubs in cattle. The effect of Ruelene on bovine fetuses was studied by injecting 8.8 g of Ruelene into the jugular vein or into the amniotic sacs of 16 pregnant heifers at 35 days after conception. No abnormal fetuses were obtained at 180 days gestation and fetal size was similar to fetuses obtained from 16 saline injected controls. Placental transfer was studied using tert-butyl-^{14}C Ruelene. Four pregnant heifers were each given a jugular injection of ^{14}C-Ruelene (100 μCi) at 180 days gestation and fetuses were taken at 0.5, 3, 8, and 16 hours after injection. Changes in the amount of radioactivity were determined in urine, blood and tissues of heifers, in blood and tissues of fetuses and in amniotic fluid. Within 8 hr, 56% of the radiocarbon was excreted in the urine. On the basis of radiocarbon analysis of maternal blood samples,

the total blood pool contained 13.7, 3.4, 0.7, and 0.2% of the dose at 0.5, 3, 8, and 16 hr respectively, compared to 5.1, 3.5, 2.5, and 0.8% on the basis of fetal blood analysis. Blood and tissue analyses indicated that Ruelene or its metabolites readily cross the placental barrier, however, rapid urinary excretion by the dam indicated the fetuses were protected from a portion of the dose. (Abstract number 215, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1690. Kopaczyk-Locke, K. (Biochem. Toxicol. Branch, Div. of Toxicol., Food and Drug Admin., Washington, DC 20204). **Effects of paraquat and diquat on rat liver mitochondria.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 250; 1973.*

Rat liver mitochondria were exposed to different levels of the herbicides, paraquat (P) and diquat (D) using succinate (S), pyruvate + malate, glutamate + malate, β-hydroxybutyrate, α-ketoglutarate (α-Kg) and ascorbate-TMPD (N,N,N′N′-tetramethyl-p-phenylenediamine dihydrochloride) as substrates. O_2 uptake was measured polarographically. The incorporation of 1,1′-di $^{14}CH_3$-paraquat into mitochondria was studied as a function of time, and the nature of the incorporated activity was investigated. The oxidation rates of all substrates studied were stimulated by P or D to 2-5 times control values, depending upon substrate and herbicide concentrations. P and D effects on S oxidation occurred only after a delay. This delay was eliminated by incubating mitochondria with P or D, prior to S addition. P and D increased state 4 oxidation and ATPase activity, and decreased respiratory control and ADP/O ratios. Following the initial lag period, the incorporation of ^{14}C-P was linear with time. These and other studies suggest that P and D exert their effects by stimulating citric acid cycle dehydrogenase and uncoupling oxidative phosphorylation. (Abstract number 216, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1691. Sidell, F. R.; Groff, W. A. (Biomed Lab., Edgewood Arsenal, MD 21010). **The use of VX as an antidote to anticholinergic intoxication in man.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 304; 1973.*

VX [*S*-(2-diisopropylaminoethyl)-ethyl methylphosphonothiolate], a potent cholinesterase inhibitor, effectively reversed the central effects (delirium) produced by scopolamine and two synthetic anticholinergic compounds in man when VX was administered intravenously. The therapeutic effectiveness of VX was not diminished by the previous, simultaneous, or subsequent administration of pralidoxime chloride which restored the red blood cell cholinesterase inhibition produced by VX. However, VX administered orally in a dose that produced equivalent red blood cell cholinesterase depression was ineffective. (Abstract number 502, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1692. Wakeling, A. E.; Schmidt, T. J.; Visek, W. J. (Cornell Univ., Ithaca, NY 14850). **Insecticide inhibition of 5α-dihydrotestosterone binding.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 319; 1973.*

Sucrose density-gradient analysis of rat prostate cytosol incubated with ^{3}H-5α-dihydrotestosterone (^{3}H-5α-DHT) in the presence of 0.4*M*KCl, showed a large binding peak in the 3.5S region. Dieldrin and *o,p′*-DDT strongly inhibited this binding. Since cyproterone acetate did not inhibit the 3.5S binding, the binding was not saturated by physiological concentrations of ^{3}H-5α-DHT and a similar binding peak was demonstrated in serum, liver, and kidney cytosols, the binding in the 3.5S region was mainly non-specific. Sucrose density-gradient analysis of similar binding fractions, in the absence of 0.4*M* KCl, showed two binding regions, a 3.5S nonspecific and an 8S specific region. Dieldrin and *o,p′*-DDT strongly inhibited binding of ^{3}H-5α-DHT to the specific receptor. Measurements of available receptor concentration by Agarose column chromatography, in the presence or absence of dieldrin and *o,p′*-DDT confirmed the inhibition of binding of ^{3}H-5α-DHT by the insecticides demonstrated by sucrose density-gradient analysis. (Abstract number 584, Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission).

73-1693. Peters, D. A. V.; Hrdina, P. D.; Singhal, R. L.; Mazurkiewicz-Kwilecki, I. (Dept. of Pharmacol., Univ. of Ottawa, Ottawa, Canada). **Comparison of the acute and chronic effects of chlordane and DDT on brain biogenic amines.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 320; 1973.*

Administration of an acute dose (200 mg/kg p.o.) of α-chlordane resulted in tremors, convulsions and a marked fall in body temperature. Four hours after α-chlordane, there was a significant drop in striatal ACh (26%) and brain-stem NE (21%). The 5-HT content of the brain-stem remained unchanged whereas 5-HIAA levels increased significantly by 36% of the control values. Treatment with *p,p′*-DDT (600 mg/kg p.o.) produced qualitatively similar changes in the levels of various biogenic amines. However, administration of *p,p′*-DDT resulted in marked hyperthermia which was in contrast to the decrease in body temperature seen with α-chlordane. In addition, the tremors were more pronounced and the convulsions occurred later and were less intense than those observed after α-chlordane. Chronic exposure to small doses of α-chlordane (5 or 25 mg/kg/day for 45 days) resulted in a small increase in body temperature without any significant changes in brain ACh, NE, 5-HT and 5-HIAA levels. Chronic treatment with similar doses of *p,p′*-DDT elevated the body temperature and produced slight ataxia in animals

receiving the higher dose. Striatal ACh was lowered by both doses of *p,p'*-DDT whereas the brain-stem 5-HIAA was significantly enhanced only in rats given the 25 mg/kg dose of the insecticide. (Abstract number 589, Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1694. Davison, K. L.; Sell, J. L. (U.S. Dept. of Agr., Agr. Res. Service, Metabolism and Radiation Lab., Fargo, ND 58102). **DDT and dieldrin effects on mallard ducks.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 320; 1973.*

Two hundred and forty adult mallards were divided into 30 groups, six females and two males per group, and fed a control diet, or one containing 2, 20, or 200 ppm of technical or *p,p'*-DDT, or 1, 5, or 10 ppm of dieldrin to determine some effects of these insecticides on eggshell thickness and reproduction, and on some hepatic mixed-function oxidases. Effects of technical and *p,p'*-DDT were similar. Dietary DDT at 200 ppm was lethal to most ducks, with deaths beginning by the 5th week. Eggshell thickness was reduced about 10 and 20% when 20 and 200 ppm of DDT were fed, but was not reduced when 2 ppm of DDT was fed. Fertility and hatchability were not affected by either DDT or dieldrin. Hepatic microsomal cytochrome P450 concentration of adult ducks fed dieldrin or up to 20 ppm of DDT did not differ from that of controls. Both dieldrin and DDT increased cytochrome P450 concentration in livers of newly hatched ducklings. Aniline hydroxylase and aminopyrine *N*-demethylase activities in livers of adults or ducklings were not measurably affected by either insecticide. (Abstract number 590, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1695. Puyear, R. L.; Thacker, E. J. (Zoology Dept., N. Dakota State Univ., Fargo, ND 58102). **Influence of DDT and barbitals on tissue and urinary ascorbic acid levels in birds and rats.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 320; 1973.*

The feeding of 100 and 1000 ppm *o,p'*-DDT in the diet of male rats for 8 days resulted in no change in liver or kidney ascorbic acid (AsA). Urinary AsA was elevated 2-8 times within 24 hours after the treatment started and peaked within 36 hours. Feeding 10 ppm *o,p'*-DDT caused no change in tissue or urinary AsA. One hundred ppm *p,p'*-DDT fed to quail for 14 days caused a 29% reduction in kidney AsA ($P < 0.05$) but no change in liver AsA. Fourteen days of pentobarbital (40 mg/kg/day ip) treatment decreased AsA in duck liver and quail kidney ($P < 0.05$). Sodium barbital (140 mg/kg ip) injected into male rats increased AsA in liver (30%), kidney (53%) and urine (100%) within 5 hours. Feeding sodium barbital (140 mg/kg/day) for 8 days resulted in a steady climb in rat urinary AsA. These results indicate that DDT caused no change in tissue AsA but elevated urinary AsA in the rat and reduced AsA in quail kidney. Sodium barbital elevated tissue and urinary AsA in the rat. Pentobarbital decreased tissue AsA in duck and quail. (Abstract number 591, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1696. Petrella, V. J.; Webb, R. E. (Dept of Biochem. and Nutrition, Virginia Polytechnic Inst., Blacksburg, VA 24601). **Excretion of ^{14}C-endrin and its metabolites in endrin susceptible and resistant pine mice (*Microtus pinetorum*).** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 320; 1973.*

It is hypothesized that endrin metabolism may partially contribute to the greater protection of resistant (R) animals from the toxic effects of endrin as opposed to susceptible (S) animals (*Science* 156; 1762, 1967). F_1 offspring born of endrin resistant and susceptible parents, and having LD50s of 18.97 ± 1.78 mg/kg and 2.56 ± 0.23 mg/kg, respectively, were dosed for 9 days with 0.51 mg/kg ^{14}C-endrin (specific activity 2.19 mCi/mmole) and feces and urine were collected. R animals excreted 71% of the administered radioactivity (18% in urine, 53% in feces), whereas S animals excreted 51% of the dose (23% in urine, 27% in feces). Fecal metabolite(s), expressed as percent of the dose, were compared for the two strains. An approximate 2-fold greater amount was observed in the R animals. The metabolite(s) appeared to be identical for both strains as observed with gas-liquid, column and thin-layer chromatographic techniques, and were also similar to published fecal metabolites in the rat (*J. Agr. Food Chem.* 18: 117, 1970). The increased rates of excretion and metabolism may play a part in the mechanism of resistance observed in these animals. (Abstract number 593, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1697. Kuba, K.; Albuquerque, E. X.; Bernard, E. A. (Dept. of Pharmacol. and Biochem., State Univ. of New York at Buffalo, Buffalo, NY 14214). **DFP on end-plate currents of frog skeletal muscles.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 333; 1973.*

Diisopropylfluorophosphate (DFP, $10^{-3}M$), an irreversible inhibitor of cholinesterase, reduced the amplitude, shortened the time course (50%) and shifted to more negative values the equilibrium potential of the endplate current (EPC) of the nerve-sartorius muscle of the frog. In controls the half-decay time (HDT) of the EPC is potential-dependent; in the presence of DFP it became much less so. Removal of the excess DFP by washing the muscles in normal Ringer resulted in partial recovery of the EPC amplitude and a 20-fold increase in the HDT. In comparison with control, when tetanic stimulation was applied (25 cps) in the presence of DFP (and also after wash), the first 5 EPC's were augmented and subsequent EPC's declined in amplitude; the

amplitude of the EPC decreased about 60%. Treatment of 30 min with pyridine-2-aldoxime methiodide (2-PAM, $9 \times 10^{-3} M$), which de-phosphorylates the inhibited sites, followed by wash, restored the EPC amplitude and the HDT almost to control values. The decay of the EPC during DFP treatment followed a 2-step exponential function; after washing the preparation prior to 2-PAM treatment it returned to a 1-step exponential function similar to control but with a much longer time constant. Thus, DFP acts on 1) the ionic conductance modulator (ICM) of the EPC and 2) cholinesterase. It is suggested that the kinetics of ACh interaction with its receptor sites have a much faster time course than those of the ICM changes. (Abstract number 664, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1698. Laskowski, M. B.; Dettbarn, W. D. (Dept. of Pharmacol., Vanderbilt Univ. Sch. of Med., Nashville, TN 37203). **Increased acetylcholine release in the presence of an irreversible inhibitor of cholinesterase.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 333; 1973.*

Paraoxon (PX), an irreversible organophosphorus inhibitor of cholinesterase (ChE), produces a marked increase in spontaneous acetylcholine release from motor nerve terminals in the rat diaphragm. Animals sacrificed 30 min after an acute i.p. injection of 0.5 mg/kg PX display MEPP frequencies of 46 ± 4.7/sec (± S.E.) which gradually fall to control rates (3.2 ± 0.35/sec) in animals sacrificed 6 hr after a single injection. The decline in MEPP frequency is significantly faster if diaphragms are perfused with 1.6×10^{-6} M tetrodotoxin (TTX). MEPP frequency after TTX is 18 ± 3% of rates after PX while the frequency over a comparable time period is 61 ± 4% in diaphragms without TTX. The PX-accelerated MEPP frequency is reduced but not entirely eliminated if diaphragms are perfused with TTX (8.8 ± 3.5/sec) or if ChE is reactivated by 10^{-3} M pyridine-2-aldoxime methiodide (2-PAM, 10 ± 1.8/sec). Although the increased MEPP frequency is not significantly affected by solutions containing 3 m*M* or 12 m*M* Mg, it is almost entirely eliminated in Ca-free solutions with 1 m*M* EDTA. It is proposed that while a part of the presynaptic action of PX may be due to TTX-susceptible antidromic nerve action potentials, a more direct action of PX is indicated. (Abstract number 665, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1699. Vick, J.; Johnson, R.; Groff, W.; Hassett, C. C. (Biomed. Lab., Edgewood Arsenal, MD 21010). **Recent studies on the therapy of cyanide poisoning.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 372; 1973.*

Cyanide is uniformly lethal to both man and experimental animals in extremely small doses. Cardiovascular drugs and/or artificial respiration have been used in attempts to support the respiratory failure, cytochrome oxidase inhibition, and cardiovascular failure. In the first phase of this study oxygen with artificial ventilation was evaluated. If initiated prior to cardiovascular collapse, oxygen prevented death in 5 of 10 dogs. After cardiovascular failure oxygen was ineffective. A second series of 40 dogs were used to study vasoactive agents; vasodilators were found to be effective but only when given prior to cyanide. This is in contrast to amyl nitrite which reversed both the cardiovascular and the respiratory failure in 10 of 10 dogs. These changes occurred prior to the formation of methemoglobin by amyl nitrite and appears due to inhibition of a histamine induced venous pooling. It is proposed that early death from cyanide is cardiovascular in nature rather than through poisoning of the cytochrome oxidase system. (Abstract number 868, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1700. Martz, F.; Straw, J. A. (Dept. Pharmacol., George Washington Univ. Sch. of Med., Washington, DC 20005). **Mitotane decreases adrenal cortical heme and P450.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 734; 1973.*

Mitotane (*o,p'*-DDD, TDE) is adrenocorticolytic in dogs and humans and blocks several P450 mediated steps in steroidogenesis. To determine whether a decrease in P450, heme, and protein is involved in the drug action, male mongrel dogs were anesthetized, the right (control) adrenal removed, and *o,p'*-DDD (60 mg/kg i.v.) given. The left adrenal was removed three hours later. P450 values in mitochondria of treated animals averaged 6.19 nmole/g compared to 8.54 in controls; P420, 1.90 nmole/g compared to 1.05 in controls; heme, 16.35 nmole/g compared to 20.14 in controls; and protein, 6.90 mg/g compared to 6.76 in controls. In the microsomes corresponding values were P450, 4.07 nmole/g in treated animals and 8.96 in controls; P420, 0.78 nmole/g in treated animals and 0 in controls; heme, 6.76 nmole/g in treated animals and 14.68 in controls; and protein, 3.41 mg/g in treated animals and 5.26 in controls. The loss of measured heme suggests that disruption of the heme portion of P450 is responsible for the measured P450 loss. The resemblance of these effects to those of carbon tetrachloride in rat liver suggests that adreno toxicity of *o,p'*-DDD results from its metabolism by the adrenal to an active form, analogous to carbon tetrachloride activation in the liver. (Abstract number 2931, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1701. Wheeler, L.; Strother, A. (Loma Linda Univ., Loma Linda, CA 92354). **Subcellular distribution and inhibition of acetylcholinesterase by Zectran in fetal and maternal brain and liver.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 745; 1973.*

After a single IP injection to the mother (1.5 mg/kg, 2μc ^{14}C-Zectran) the distribution of Zectran, a

pesticidal acetylcholinesterase (AChE) inhibitor, was studied in Sprague-Dawley rats from 15 minutes to 8 hours. At 15 min the maternal brain (MB) and fetal brain (FB) concentrations were approximately the same but elimination was much slower from FB than MB. The purpose of this study was to determine if the Zectran concentrations found in the distribution study could significantly inhibit fetal AChE. One hour after the maternal injection, tissues were isolated and fractionated by centrifugation into 700 x G 3300 x G, 10,000 x G, 192,000 x G soluble fraction. An aliquot from each fraction was solubilized in NCS to determine ^{14}C activity. Activity of ACHE was determined in the remainder by a modification of the method of Fonnum (*Biochem. J.*, 115: 465; 1969). Control AChE was 660, and 444 μm/g protein/hr for FB and FL (fetal liver) respectively. AChE from Zectran injected animals was 530 and 206 μm/g protein/hr for FB and FL and 35-50% of the AChE activity in FB and FL was found in the 192,000 x G fraction. Phenobarbital pretreatment slightly enhanced AChE. (Abstract number 2991, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1702. Eling, T. E.; Orton, T. C.; Pickett, R. D.; Anderson, M. A.; Fouts, J. R. (Nat. Inst. of Environ. Health Sci., Research Triangle Park, NC 27709). **Xenobiotic accumulation in the isolated perfused rabbit lung.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 748; 1973.*

An isolated rabbit lung preparation was developed for the investigation of the accumulation and metabolism of drugs by this organ. The preparation was shown to be viable during perfusion for 2 hours with whole, heparinized blood. Light and electron microscopy indicated no abnormalities. The disappearance from blood and accumulation into lung of ^{14}C amines was studied. In contrast to non-basic amines (aniline, imidazole, triazine herbicides), basic amines (amphetamine, imipramine, chlorcyclizine, methadone) attained high tissue/blood ratios. This accumulation was rapid, equilibrium being reached within 10 minutes. The accumulation of non-basic amines was non-saturable, while that of basic amines was saturable, possibly consisting of two processes, one of high affinity and low capacity and another of low affinity and high capacity. Mutual inhibition of uptake occurred with basic amines but not with non-basic amines. The accumulation of basic amines was also inhibited by a reduction in temperature. These data indicate a possible transport and/or storage process for basic amines into pulmonary tissue. (Abstract number 3006, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1703. Gardiner, T. H.; Schanker, L. S. (Univ. of Missouri-Kansas City, Kansas City, MO 64110). **Effect of paraquat-induced lung damage on permeability of rat lung to drugs.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 748; 1973.*

Administration of the herbicide paraquat to rats or mice produces lung damage that resembles interstitial pulmonary fibrosis (*Am. Rev. Resp. Dis.* 105: 276, 1972), idiopathic respiratory distress syndrome (*J. Pathol.* 103:239, 1971), and chronic interstitial pneumonia (*Lab. Invest.* 25:536, 1971). To investigate the effects of paraquat-induced lung damage on pulmonary absorption of drugs, rats were given either a single oral dose of paraquat (250 mg/kg) or saline (control). Drugs investigated were procaine amide ethobromide HBr (PAEB), *p*-aminohippuric acid (PAH), and procaine amide HCl. To compare rates of absorption in damaged and control lungs, 0.1 ml of drug solution (10 mM) was administered through a tracheal cannula to anesthetized animals. After various times, lungs were assayed for unabsorbed drug. Rates of drug absorption increased 1.4-2.8 fold at 3-5 days after paraquat administration and returned to near control values by the fifteenth day. A striking parallelism existed between increased lung permeability and degree of lung edema. The results suggest that paraquat-induced lung damage increases the porosity of the pulmonary membrane. (Abstract number 3007, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1704. Stevens, J. T.; Greene, F. E.; Passananti, G. T. (Dept. of Pharmacol., The M. S. Hershey Med. Cent., Pennsylvania State Univ., Hershey, PA 17033). **Binding of malathion, parathion, and their oxygenated analogs to cytochrome P-450 in the rat.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 761; 1973.*

Malathion and parathion have been shown to inhibit metabolism by the hepatic microsomal mixed function oxidase (MFO) system in vitro and in vivo; paraoxon decreased the metabolism of Type I substrates but enhanced aniline biotransformation in the mouse. Therefore, an assessment of interactions of these insecticides with MFO system seemed obligatory. The addition of parathion, malathion, and malaoxon, oxygenated analog of malathion, to suspension of rat liver microsomes produced typical Type I spectral changes, while paraoxon produced an atypical spectral shift with a maxima at 396 nM and no minima. Spectra for both parathion and paraoxon were corrected for inherent absorption in the region of 340 to 380 nM. Parathion and paraoxon were bound to cytochrome P-450 with relatively high affinity ($ki = 10^{-6} M$); whereas, malaoxon had a $ki = 3.5 \times 10^{-5} M$. The unusual Lability of malathion in microsomal suspensions made it impossible to determine an accurate *ki* for this agent. Interestingly enough, although malathion and parathion inhibited the metabolism of both Type I and Type II substrates, their oxygenated metabolites only inhibited Type I and enhanced aniline hydroxylase (Type II) activity. (Abstract number 3086, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1705. Kacew, S.; Singhal, R. L. (Pharmacol. Dept., Ottawa Univ., Ottawa, Canada). **Stimulation of kidney cortex cyclic 3′, 5′-adenosine monophosphate-H^3 formation by DDT and related insecticides.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 802; 1973.*

Administration of chlorinated hydrocarbon pesticides was found to enhance the activities of several important key hepatic and renal gluconeogenic enzymes, elevate serum glucose and urea, and deplete liver glycogen. Since the insecticide-induced changes in carbohydrate metabolism appear to be similar to those produced by exogenous cyclic AMP, the influence of these compounds was examined on the ability of kidney cortex to synthesize cyclic AMP-H^3 from radioactive adenosine in vitro. A significant stimulation of cyclic AMP-H^3 formation was noted when renal cortices were incubated with DDT, chlordane, endrin, dieldrin, and heptachlor. The presence of caffeine increased kidney cyclic nucleotide production and was capable of potentiating the action of *p,p′*-DDT. In contrast, imidazole, known to stimulate the activity of phosphodiesterase, effectively reduced the DDT-induced rise in cyclic AMP-H^3 formation; prostaglandin E_1 and $F_2\alpha$ exerted no significant effects. Our results suggest that the changes in carbohydrate metabolism seen after various chlorinated hydrocarbon insecticides may be related to their ability to enhance the synthesis of kidney cortex cyclic AMP–H^3. (Abstract number 3297, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1706. Weber, R. P.; Coon, J. M.; Triolo, A. J. (Thomas Jefferson Univ., Philadelphia, PA 19107). **Effects of paraoxon on biliary excretion and distribution of benzo (*a*) pyrene in the rat.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 810; 1973.*

Male adult rats were pretreated with paraoxon (0.3 mg/kg/day ip) for 5 days; 24 hr after the last dose ^{14}C-benzo(*a*)pyrene (BP) (2.5 mg/kg) was injected into the femoral vein and the biliary excretion of radioactivity was followed for 90 min. The paraoxon treated rats excreted lower levels of radioactivity in the bile than the controls. This difference was significant at 60, 75, and 90 min after the administration of BP. There was no significant difference in bile flow between the two groups. In paraoxon treated animals the disappearance of radioactive isotope from whole blood was significantly delayed at 3 and 6 min after the administration of BP. Tissue analysis by hexane extraction and thin layer chromatography showed that pretreatment with paraoxon lowered the levels of radioactive metabolites in liver and small intestine but not in kidney, brain, and lung. These studies indicate that paraoxon given subacutely causes an inhibition of the metabolism of BP as demonstrated by the lower levels of radioactive metabolites in the bile, liver and small intestine of paraoxon treated animals (Abstract number, 3337, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1707. Lech, J. J.; Pepple, S.; Anderson, M. (Med. College of Wisconsin, Milwaukee, WI 53233). **Effects of novobiocin on the acute toxicity, metabolism and biliary excretion of 3-trifluoromethyl-4-nitrophenol in rainbow trout.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 810; 1973.*

Previous studies have indicated that the major metabolite of the lamprecide, 3-trifluoromethyl-4-nitrophenol (TFM), in rainbow trout is the glucuronide conjugate. The effects of novobiocin on the acute toxicity and disposition of TFM were studied in an attempt to evaluate the toxicological importance of glucuronide conjugation in trout. Pretreatment of rainbow trout with 200 mg/kg novobiocin ip decreased the 3 hr LC50 of TFM from 5.200 mg/L. to 2.48 mg/L. Temporally associated with the increase in toxicity was an elevation of total ^{14}C-TFM in the tank water. Analysis of blood, brain, and liver revealed increased levels of unconjugated TFM in these tissues from novobiocin pretreated trout. Novobiocin also increased the tl/2 of TFM in blood when TFM was injected ip. In addition, novobiocin pretreatment resulted in a sharp decrease in biliary excretion of TFM glucuronide and an increase in blood levels of TFM glucuronide when ^{14}C-TFM was given by ip injection or by exposure in the tank water. These studies indicate that glucuronide formation and biliary excretion of the conjugate in trout may proceed at rates sufficient to afford protection from TFM and possibly other toxic phenols. (Abstract number 3338, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1708. Tinsley, I. J.; Lowry, R. R. (Dept. Agr. Chem., Oregon State Univ., Corvallis, OR 97331). **The influence of dieldrin on the essential fatty acid requirement of the rat.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 920; 1973.*

Mixtures of hydrogenated coconut oil and safflower oil were used to provide 0, 0.4, 0.8, 1.6, 3.2 and 6.4% of calories as linoleate (18:2) in rations containing 25% fat. Food efficiency data from a 12-week feeding period indicated an optimum level of 0.8-1.6% calories as 18:2 for females. Males attained maximum food efficiency at the same dietary level of 18:2 with further increase being without effect. Addition of dieldrin (30 ppm) to these rations did not influence the level of 18:2 required for maximum food efficiency, but it did accentuate the response to the nutritional stress. Dieldrin also produced substantial increases in the quantity of the 18:2 series of polyunsaturated fatty acids in liver, the response varying with sex and dietary level of 18:2. This latter response is attributed to the proliferation of the smooth endoplasmic reticulum and could produce an imbalance in the overall distribution of essential fatty acids. These data suggest such a mechanism could be a factor with males but not females. (Abstract number 3941, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1709. Lukic, M.L.; Popeskovic, Lj.; Jankovic, B. D. (Immunol. Res. Cent., P.O. Box 979, 11000 Belgrade, Yugoslavia). **Potentiation of immune responsiveness in rats treated with DDT.** *Fed. Proc. Fed. Amer. Soc. Exp. Biol. 32(3): 1037; 1973.*

Female Wistar rats were treated perorally for 60 days with technical grade DDT in corn oil. Controls received only oil. A daily intake of 40 mg/kg b.w. of DDT did not cause significant toxic effects. Both groups of animals were immunized with 0.5 mg of BSA in complete Freund's adjuvant on day 21 of the treatment, and tested every week for Arthus reactivity, delayed skin sensitivity and antibody formation. DDT exerted a potentiating influence on both humoral and cellular immune responses. The difference between DDT-treated and control rats with respect to the production of mercaptoethanol-resistant antibody and intensity of delayed skin reaction was most pronounced 35 days after immunization. At that time immune reaction in control rats significantly decreased. Histological examination of various tissues revealed only hemorrhages and necrotic changes in the adrenal cortex. These results suggest that DDT acts most probably by removing normal inhibitory homeostatic activity of adrenal glucocorticosteroids. (Abstract number 4615, 57th Annual FASEB Meeting, Atlantic City, NJ, April 15-20, 1973, reprinted by permission)

73-1710. Geldmacher-v. Mallinckrodt, M.; Lindorf, H. H.; Petenyi, M.; Fluegel, M.; Fischer, T.; Hiller, T. (Inst. f. Rechtsmed., Erlangen-Nuernberg Univ., Erlangen, Germany). **Genetisch determinierter Polymorphismus der menschlichen Serum-Paraoxonase (EC 3.1.1.2). [Genetically determined polymorphism of human serum paraoxonase (EC 3.1.1.2).]** *Humangenetik 17(4): 331-335; 1973.* (19 references) (German)

Genetically determined polymorphism of a human serum enzyme, aryl esterase (paraoxonase, EC 3.1.1.2) which splits off *p*-nitrophenol from paraoxon, was studied. A highly significant correlation with a factor of $^{+}0.82$ between serum cholinesterase residual activity and serum paraoxonase activity was determined. The paraoxonase shows a polymorphism which, as was proved by an investigation of 35 families with 52 children, is probably genetically determined and which follows a simple 2-allele model.

73-1711. Costa, H. H. (Dept. Zool., Vidyalankara Univ. of Ceylon, Kelaniya, Ceylon). **Effects of some common insecticides and other environmental factors on the heart beat of *Caridina pristis*.** *Hydrobiologia 35(3-4): 469-480; 1970.* (7 references)

Three organochlorine insecticides affected the rate of heart pulsation of the shrimp, *Caridina pristis*. DDT at 2.5 ppm regularly interrupted the heart beat in diastole, increased pulse rate, and caused cardiac arrest within about 30 min. One half that concentration initially increased heart rate then decreased it, prolonged diastolic periods, and caused cardiac arrest within 70 min. Regular stoppages at diastole were seen with concentrations as low as 0.005 ppm. Dieldrin at 2.5 ppm initially accelerated heart rate, and pulsations became slow and imperceptible by 60 min. Exposure to 1.25, 0.62, and 0.1 ppm dieldrin increased heart rate lasting for 100 min, the duration of the experiment. BHC at 0.1 and 0.05 ppm resembled DDT in its effect on heart rate.

73-1712. Goncharuk, G. A. (Bogomolets Med. Inst., Kiev, USSR). **Experimental investigation of the effect of organomercury pesticides on generative function and on progeny.** *Hyg. Sanit. 36(7/9): 40-44; 1971.* (4 references)

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(7): 32-35; 1971, see Abstract no. 72-0120.

73-1713. Aleksandrova, L. G.; Klisenko, M. A. (Kiev Occup. Health Res. Inst., USSR). **On the metabolism of *N*-phenylcarbamic acid derivatives in warm-blooded animals.** *Hyg. Sanit. 36(7/9): 299-301; 1971.*

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(8): 108-109; 1971, see Abstract no. 72-1021.

73-1714. Litvinov, N. N.; Nikonova, A. G. (Sysin Inst. of Gen. and Environ. Hyg., Acad. Med. Sci., Moscow, USSR). **Effects of "Alkilsul' fat" on absorption of pesticides and on pesticide content in the organs of experimental animals.** *Hyg. Sanit. 36(7/9): 351-355; 1971.* (12 references)

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(9): 21-25; 1971, see Abstract no. 72-0340.

73-1715. Vojvodic, V.; Milosevic, M. (Inst. Pharmacol. Toxicol., Fac. Med., Belgrade, Yugoslavia). **Some pharmacological actions of oximes and atropine on the cardiovascular effects produced by pinacolyl methylphosphonofluoridate (soman) in rats.** *Iugoslav. Physiol. Pharmacol. Acta 7(3): 439-446; 1971.* (38 references)

Soman, administered intravenously to rats, produced a dose-dependent rise in arterial blood pressure and caused ECG disturbances including sinus bradycardia, reduction in the height of the P-wave, prolongation of the P-Q interval, atrioventricular block, and prolongation of the QRS complex. A 10 μg/kg dose increased arterial blood pressure to 54 mm Hg, which was maintained for at least 60 min. The blood pressure rise could be brought to normal by intravenous administration of 12.5 or 25.0 mg/kg TMB-4, or 5 mg/kg atropine sulfate, but not 25 or 50 mg/kg PAM-2Cl. Neither oxime injected immediately before soman

prevented or reduced the hypertensive effect while atropine completely blocked this effect. The bradycardia produced by soman was temporarily abolished by intravenous injection of 50 mg/kg PAM-2Cl or 25 mg/kg TMB-4. Atropine counteracted the bradycardia for the longest amount of time (60 min). The effects of the oximes were observed without simultaneous reactivation of ChE, supporting the opinion that they are probably due to anti-ACh properties.

73-1716. Liu, L. C.; Cibes-Viade, H. R. (Agr. Exp. Station, Mayaguez Campus, Univ. Puerto Rico, Rio Piedras, Puerto Rico). **Effect of various herbicides on the respiration of soil microorganisms.** *J. Agr. Univ. P.R. 56(4): 417-425; 1972.* (12 references)

A close relationship was observed between soil type and the degree of toxicity of an herbicide in a study of the effect of 10 chemicals on gross respiration of soil microorganisms in three types of Puerto Rican soil. At 10 ppm (equivalent to application of 4 lbs/acre) ametryne, atrazine, bromacil, diuron, fluometuron, linuron, prometryne, trifluralin, and 2,4-D, but not terbacil, inhibited oxygen consumption slightly in Coto clay soil. At 100 ppm trifluralin and 2,4-D further reduced uptake and fluometuron stimulated it. In Fraternidad clay soil none of the herbicides at 10 ppm had a noticeable inhibitory effect on oxygen consumption and some compounds increased activity. At 100 ppm oxygen uptake was generally inhibited. Ametryne, trifluralin, and 2,4-D had the greatest effect. Trifluralin and 2,4-D caused more severe reductions in oxygen uptake at 250 ppm. All but linuron increased oxygen consumption at 10 ppm in San Anton sandy loam. An increase in respiration was observed when the herbicides were applied at 100 ppm with all but trifluralin. At 250 ppm fluometuron and trifluralin markedly inhibited uptake, while linuron enhanced it.

73-1717. Young, M. L.; Mitchell, G. V.; Seward, C. R. (Div. Nutr., Food and Drug Admin., HEW, Washington, DC 20204). **Effect of protein and methionine on vitamin A liver storage in rats fed DDT.** *J. Nutr. 103(2): 218-224; 1973.* (22 references)

The effect of level and quality of dietary protein, with and without supplemental methionine, on vitamin A storage was investigated in rats fed DDT. Weanling rats were fed for four weeks with diets containing 10 or 20% casein or soybean isolate. Each level of protein source was also fed with 0.4% methionine, 200 ppm DDT, or a mixture of the two. DDT decreased the storage of vitamin A in the liver 33% with either level of soy protein and methionine did not alter this effect. Liver vitamin A was reduced 42% in rats fed DDT and 20% casein diet, and addition of methionine resulted in a smaller reduction. Methionine increased the amount of DDT, DDE, and TDE, and lipids stored in the liver in all but the 20% casein-fed rats. The quality and quantity of dietary protein apparently influences the degree of effects observed with DDT.

73-1718. Savarie, P. J.; Matschken, G. H.; Schafer, E. W.; Dasch, G. J. (Denver Wildl. Res. Center, U.S. Bureau of Sport Fisheries and Wildl., Denver, CO 80225). **UK 786 possible species-specific toxicant for Norway rats.** *Nature (London) 241(5391): 551-552; 1973.* (9 references)

Previous studies indicated that UK 786, or 5-(*N*-piperidino)-10,11-dihydro-5*H*-dibenzo (a,d)-cycloheptene, might be a highly specific toxicant for rats. Single doses of UK 786 were administered to bobwhite quail, pigeon, starling, red-winged blackbird, house sparrow, domestic rabbit, deer mouse, gerbil, ricefield rat, wild Norway rat, Polynesian rat, albino rat, and albino mouse by stomach tube. None of the tested birds given 100 or 500 mg/kg of UK 786 died. One of three rabbits given 500 mg/kg died, as did 2 of 8 deer mice given 1600 mg/kg. No fatalities were recorded in 4 gerbils given UK 786 at 500 mg/kg, or in 8 ricefield rats given up to 120 mg/kg. The LD50 found in 12 male wild Norway rats was 8.4 mg/kg and in females, 8.9 mg/kg. The LD50 in albino male laboratory rats was 11.9 mg/kg and in wild Polynesian rats, 354 mg/kg. The LD50 for the laboratory white mouse was 205 mg/kg. Bait acceptance by ricefield and Polynesian rats was poor at high toxicant concentrations. Acceptance by Norway rats was also poor at high concentrations, but the rats ate enough bait containing 2% UK 796 to cause 80% mortality. Consumption of treated tablets by rats varied widely after prior contact.

73-1719. Beeman, R. W.; Matsumura, F. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **Chlordimeform: a pesticide acting upon amine regulatory mechanisms.** *Nature (London) 242(5395): 273-274; 1973.*

Chlordimeform, a pesticide which causes sympathomimetic rather than cholinomimetic symptoms of poisoning, inhibited rat liver monoamine oxidase. The inhibitory potency of analogs of this compound corresponded in general to their in vivo toxicity in mites. Male rats treated with 200 mg/kg chlordimeform had levels of serotonin and norepinephrine 70 and 22% higher than control animals. These findings are significant in the light of the need to develop substances which act on different pharmacologic principles as substitutes for environmentally hazardous pesticides.

73-1720. Nagasaki, H.; Tomii, S.; Tsumashika, T.; Marukami, M.; Arai, M.; Ito, N. (Nara Medical College, Sch. of Hyg., Japan). **[On the experimental tumorigenesis of the liver of mice and rats by the induction of BHC isomers, α-, β-, γ- and δ-.]** *Nippon Gangakkai Kiji (Proc. Jap. Cancer Ass.) 31: 33; 1972.* (Japanese)

α-, β-, γ- and δ-BHC were each mixed with a basic diet and fed to three groups of male dd mice (average body weight 19.7 g) at levels of 100, 250, and 500 ppm for 24 weeks and to three groups of Wistar rats (153 g) at levels of 250, 500, and 1,000 ppm for 24 and 48 weeks. The mice were sacrificed at 24 weeks and the rats at 24 and 48 weeks. Liver weight of mice given γ-BHC (lindane) increased, the weight ratio of liver to body being 5.28, 8.11, and 14.40% in 100, 250, and 500 ppm groups. The same tendency was also seen with the highest levels of the other isomers. Incidence of hepatoma in mice was seen only in the γ-BHC group, especially 500 and 250 ppm groups. No metastasis was seen in lymph nodes or other organs. Hypertrophic nodal pictures were found in every part of the liver. In liver cells other than the tumor parts, irregularity of nuclear size was recognized and swollen liver cells were seen in the center of lobules. These anomalies were also noticed in other isomer groups, however, without hepatoma. In the rats sacrificed at 24 weeks, the increase of liver weight was recognized only in 500 and 1000 ppm groups with hepatoma absence. At 48 weeks only one of 7 rats in the 1000 ppm γ-BHC group showed a hepatoma of 1.5 cm in diameter. Three other animals of the same group showed clear hypertrophic nodules without signs of malignant tumor as did other groups of levels and isomers. From these findings γ-BHC is considered to have carcinogenicity in the liver, and rats are less sensitive than mice.

73-1721. Tsunenari, S. (School of Legal Med., Fac. of Med., Kumamoto Univ., Kumamoto, Japan). **[Studies on an organic miticide, Azomite, from forensic toxicological aspects.]** *Nippon Hoigaku Zasshi (Jap. J. Legal Med.) 27(2): 123-133; 1973.* (32 references) (Japanese)

Azomite, a trade name for a miticidal emulsifiable concentrate mainly used for controlling *Panonychus citri*, contains 38% of azobenzene and 22% of 2-[2-*p*-*tert*-butylphenoxy)-1-methylethoxy]-1-methylethyl 2'-chloroethyl sulfite (PPPS). The effects of Azomite, its components, and several mixtures of both components, in animal experiments, and a case report of fatal acute human intoxication are presented. The acute p.o. LD50 of Azomite, azoxybenzene, PPPS, and azoxybenzene plus PPPS(1:1), (2:1), and (3:1), are 3089, 2760, 5624, 2160, 1530, and 1106 mg/kg for dd-strain mice. Toxic symptoms of Azomite in mice included reduced movement, clonic convulsions, ataxia, and irregular respiration. Early death in mice administered Azomite p.o. was caused by congestion and hemorrhage of the lungs, liver, kidney, and stomach. With late death degeneration of renal tubular epithelium pulmonary edema and hemorrhagic pneumonia, congestion in the liver, and necrosis of liver cells were noticed. TLC, UV, and GC were suitable for determining Azomite. Azoxybenzene and PPPS could be detected in the organs of rabbits killed by administration of Azomite. Forty-three percent of azoxybenzene and 38% of PPPS administered remained in the stomach, 2% and 2.5% in the liver, and 0.1% and 0.3% in the cerebrum. A 19 year old boy committed suicide by swallowing 50 ml of Azomite. Although no symptoms appeared even 19 hours after swallowing, jaundice and sporadic unconsciousness were observed at 72 hours. He fell into hepatic coma after 96 hours and died of cardiac insufficiency at 140 hours.

73-1722. Yoshida, Y.; Kono, T. (Sch. of Hyg., Osaka Medical College, Osaka, Japan). **[Mammalian toxicity of sodium 2,2,3,3,-tetrafluoropropionate.]** *Nippon Kogyo Eisei Gakkai Nenkai Hokoku (Proc. Jap. Ind. Hyg. Soc. Annu. Meeting) 46:120-121; 1973.* (Japanese)

Acute and sub-acute toxicities of the herbicide Tetrapion (sodium 2,2,3,3-tetrafluoropropionate), used for controlling pampas grass and bamboo grass in forests, were examined using dd-mice and SD-JCL rats. Tetrapion dissolved in a 0.5% aqueous CMC solution was administered to the animals by stomach tube. The acute p.o. LD50 was determined as 9.24, 9.82, 10.11, and 8.57g/kg, respectively, for male and female mice, and male and female rat. Death was seen within one day after administration, with piloerection, ataxic gait, secretion from oral cavity, dyspnea, paralytic tremor, and disappearance of righting reflex. Subacute toxicity to mice was examined by the same method by administering 6.9, 20.8, 62.5, and 187.5 mg/kg, respectively, daily for 90 days. Toxicity to rat was examined by feeding daily diet containing 0.015 and 1.150 ppm of Tetrapion for 90 days. The no-effect levels were 20.8 mg/kg/day for mouse and 200 ppm/daily diet for rat. Histopathological findings on higher doses in mice were increased Kupffer-s stellate cells, vacuolar degeneration, slight turbid swelling and general trend of congestion in the liver, and slight swelling of glomeruli and noticeable hyperemia in the kidney. A slight increase of liver and kidney weight was seen in rats given 1.15 ppm. When 0.5% aqueous CMC solution containing 1% of Tetrapion was dropped into rabbits' eyes, no effect was observed even by electron microscopy on epithelial cells of the cornea 28 days after treatment. Slight conjunctivitis was seen when Tetrapion alone got into the rabbits' eyes; the symptoms disappeared after 28 days.

73-1723. Kasai, T.; Sugimoto, T. (Biological Res. Lab., Nihon Noyaku Co. Ltd., Osaka, Japan). **[Studies on dermatitis caused by difolatan.]** *Nippon Kogyo Eisei Gakkai Nenkai Hokoku (Proc. Jap. Ind. Hyg. Soc. Annu. Meeting) 46: 122-123; 1973.* (Japanese)

Several cases of dermatitis supposedly caused by difolatan were reported. Major subjective complaints included redness, itching, and sometimes edema localized to the body part with direct contact. Results of patch tests on white guinea pigs (200-300 b.w.) are given. Twenty mg of 80% WP, technical, and purified Difolatan, and a degradation product (obtained by heating 80% WP for 2 hrs at 80°C in a boric acid buffer

solution of pH 9.2 and extracting with petroleum ether or ethyl ether and isolating by TLC) were applied. The severity of the redness and edema was graded into 5 classes from 0(-) to 4 (+++). It was found that 80% WP, technical, and purified Difolatan gave an average dermatitis index of 2.70, 1.33, and 0.67, suggesting the presence of a strong irritant in the WP and technical formulations. The alkaline degraded product caused the most serious damage. Of the nine spots other than Difolatan isolated by TLC, Fraction No. 2(*Rf* 0.85) and Fraction F (*Rf* 0.72) caused serious edema with redness. On the depilated skin of guinea pigs 5-10 micrograms caused dermatitis. These fractions were detected in technical difolatan and are considered to be formed on the plants and animal skin by degradation.

73-1724. Walker, A. I. T.; Brown, V. K. H.; Stevenson, D. E.; Thorpe, E. (Shell Res. Ltd., Tunstall Lab., Sittingbourne, Kent, England). **Toxicological studies with the insecticide tetrachlorvinphos.** *Pestic. Sci. 3(5): 517-525; 1972.* (18 references)

Acute and long-term mammalian toxicity studies have been made with the organophosphorus insecticide tetrachlorvinphos. The acute oral LD50 values for technical material were greater than the maximum dose which could be administered to guinea pig and domestic fowl (5000 and 1500 mg/kg respectively). For formulations the figures range from about 500 to > 5000 mg/kg, those containing phenol having the lowest values. In 13-week feeding studies, most changes occurred at dietary concentrations of 800 parts/million or greater with inhibition of plasma cholinesterase appearing to be the most sensitive indicator of exposure. Two hundred parts/million was considered to be without toxicological effects in rats and dogs after 3 months' feeding. In a two-year study in rats 125 parts/million produced no changes of toxicological significance. (Author abstract by permission)

73-1725. Kavadia, V. S.; Phillips, F. T. (Rothamsted Exp. Station, Harpenden, Herts, England). **The uptake of ^{14}C dieldrin via the roots of young cotton plants.** *Pestic. Sci. 3(5): 527-532; 1972.* (8 references)

The stems and leaves of young cotton plants growing in nutrient solution containing a radioactive dieldrin suspension became radioactive. After two weeks, dieldrin was taken up at a constant rate which differed slightly in different environments probably because the plants transpired at different rates. (Author abstract by permission)

73-1726. Waibel, G. P.; Speers, G. M.; Waibel, P. E. (Dept. of Animal Sci., Univ. of Minnesota, St. Paul, MN 55101). **Effects of DDT and charcoal on performance of White Leghorn hens.** *Poultry Sci. 51(6): 1963-1967; 1972.* (9 references)

White Leghorn hens were fed diets containing DDT (0 or 300 ppm) and activated charcoal (0 or 3%) in factorial arrangement for a 30 day period to study the effects on hen performance, egg quality, embryo and progeny growth. The presence of charcoal in the diet reduced the DDT deposition in the hens' abdominal fat and in the egg yolk. Charcoal also reduced yolk pigmentation. Neither DDT nor charcoal affected the egg weight or shell thickness. Embryo development from hens fed DDT and/or charcoal appeared normal. There were no differences in hatchability, fertility, or progeny growth related to the treatments. (Author abstract by permission)

73-1727. Kirchner, K. (Author address not given). **Zur Therapie von Vergiftungen mit organischen Phosphorsaeureestern bei Hunden. [On the therapy of poisonings with organic phosphate esters in dogs.]** *Prakt. Tierarzt 54(3): 97-98; 1973.* (4 references) (German)

Symptoms of parathion poisoning in dogs and problems of therapy are described. The toxic effect of parathion on dogs is based upon the phosphorylation of the acetylcholinesterase resulting in increased parasympathetic tone. Miosis due to spasm of the sphincter pupillae, hypersalivation, increased bronchial and nasal secretion, pulmonary edema with severe dyspnea and asphyxiation, bradycardia, hyperperistalsis, colic, vomiting, paresis, myoclonus, clonic-tonic spasms, and ataxia are the principal symptoms of parathion poisoning. Parathion also exerts a direct hepatotoxic effect. Effective therapy often requires high atropine doses of 5 mg/kg of body weight to be combined with obidoxime at a dosage of 10 to 20 mg/kg to prevent hepatic damage.

73-1728. Pitois, M.; Bosio, P.; Lavallee, G. (Shell Chimie, Paris, France.) **Etudes des residus detectable dans la viande, la graisse et les oeufs de poules hebergees dans des locaux traites en pulverisation avec du tetrachlorvinphos. [Residue contents in the meat, fat and eggs of chickens raised in tetrachlorvinphos-sprayed poultry houses.]** *Rec. Med. Vet. 149(1): 5-11; 1973.* (7 references) (French)

Tetrachlorvinphos residues were investigated in the meat, fat, and eggs of chickens in poultry houses which were sprayed (with chickens present) with tetrachlorvinphos at the recommended dose of 0.5 g/m^2, and at double this rate in another house. Samples of three chickens and 12 eggs from each location were analyzed by gas-liquid chromatography on the day before treatment, and 1, 2, 4, and 8 days after application. The limits of detection were 0.01 ppm in meat and fat and 0.02 ppm in eggs. After treatment at the recommended rate of 0.5 g/m^2, no residues of tetrachlorvinphos were found in meat and fat samples, but small residues of 0.04 ppm and 0.02 ppm respectively were found in the whites and yolks of egg samples taken one day after application. Samples of meat taken from the double dosed house contained no residue, but residue levels up

to 0.04 ppm were found in meat taken between 1-4 days after treatment. The residue content in egg white reached 0.08 ppm on the second day after treatment and declined afterwards, while egg yolks held up to 0.02 ppm of tetrachlorvinphos 1-4 days after treatment. The residue levels were below the detection limits in all samples eight days after treatment. No alpha isomer of tetrachlorvinphos was found in any of the samples taken.

73-1729. Lorgue, G.; Delatour, P.; Dalloz, J. P. (Author address not given). **Les organophosphores. [The organophosphorus pesticides.]** *Rev. Med. Vet. (Toulouse) 123(10): 1356; 1972.* (French)

General toxicological, symptomatologic, and therapeutic data on organophosphorus pesticides are reviewed. The oral acute LD50 values determined for malathion, dichlorvos, and parathion in rat are 1,500, 80, and 3.6 mg/kg of body weight. Since organophosphorus compounds inhibit cholinesterase, muscarinic and nicotinic syndromes occur due to the accumulation of acetylcholine. Acute intoxication is characterized by hypersalivation, lachrymation, excessive perspiration, diarrhea, abdominal pains, irregular respiration with bronchial hypersecretion, miosis, muscular paresia and fasciculation, convulsions followed by paralysis, motor coordination troubles, progressive impairment of muscular and nervous functions leading to death by asphyxiation. In rare cases of chronic poisoning paralysis of the limbs in cattle and fowl and gastric ulcers in dogs were determined as symptoms. Poisoning by organochlorine pesticides can be determined by whole blood or serum cholinesterase activity inhibition. Atropine, combinations of atropine with contrathion and diethazine, and camphor are indicated for therapy.

73-1730. Abernathy, C. O.; Casida, J. E. (Div. of Entomol. and Parasitol., Univ. of California, Berkeley, CA 94720). **Pyrethroid insecticides: esterase cleavage in relation to selective toxicity.** *Science 179(4079): 1235-1236; 1973.* (9 references)

The ester group of primary alcohol chrysanthemates is cleaved by mouse hepatic microsomal esterases, more rapidly for the (+)-*trans* than for the (+)-*cis* isomers. Substrate-specificity and inhibition studies in vivo establish that these pyrethroid-hydrolyzing esterases probably contribute to the low mammalian toxicity of bioresmethrin and other (+)-*trans* chrysanthemate insecticide chemicals derived from primary alcohols. (Author abstract by permission. Copyright 1973 by the American Association for the Advancement of Science)

73-1731. MacRae, I. C.; Vinckx, E. (Dept. Microbiol., Univ. Queensland, Brisbane, Australia). **Effect of lindane and DDT on populations of protozoa in a garden soil.** *Soil. Biol. Biochem. 5(2): 245-247; 1973.* (7 references)

Results of laboratory experiments indicated that DDT and lindane had a toxic effect on soil protozoa. The numbers of protozoa were significantly reduced immediately and 1, 2 and 3 months after application of DDT at 50 ppm and at 1, 2 and 3 months after application of DDT at 5 ppm. Both amoebae and flagellates, the most abundant protozoa, were inhibited by DDT. Numbers of protozoa in soil treated with lindane at 5 and 10 ppm were significantly lower than in control soil initially and at one month.

73-1732. Ardatova, A. N.; Poloz, D. D.; Yakusheva, O. V. (All-Union Inst. Exp. Vet., Moscow, USSR). **Toksicheskoye deystviye granozana. [Toxic effects of granosan.]** *Veterinariya (Moscow) 46: 56-58; 1969.* (Russian)

Toxic effects of granosan were studied in chickens and swine fed granosan-contaminated grain. The LD100 value for chicken was 3,000 mg of granosan or 50 mg of ethyl mercury chloride. Chickens fed a single dose developed clinical symptoms of poisoning in 3-4 days and died in 4-6 days. Chickens fed 200 mg of granosan daily over 16-23 days developed poisoning symptoms in 14-20 days and died in 16-24 days. Common symptoms of poisoning included: depression, loss of appetite, anemia and cyanosis of the comb, salivation, diarrhea, motor disorders, tonic spasms, paresis and paralysis of the limbs, increased blood sugar, and reduced pyruvic acid levels. Eggs from chickens fed a single dose of 20 mg and from other chickens fed seven daily doses of 200 mg contained mercury residues for 25 and 80 days, respectively. Swine daily fed 1 kg of grain containing 2 kg of granosan per ton developed depression, motor disorders, blindness, tremor of the skeletal muscles, clonic-tonic spasms, and coma in 15-19 days. Inflammation of the intestinal mucosa and shriveled liver and kidney were observed on autopsy. The mercury residue determined 20-25 days after the poisoning test was 1-15 mg% and 3 mg%. Muscles and liver were contaminated with mercury for two and eight months.

73-1733. Belyayev, V. I. (Author address not given). **Toksicheskoye deystviye na zhivotnykh trikhlormetafosa-3, khlorofosa i trolena. [Toxicological study of trichlorometaphos-3, trichlorfon and Trolene in animals.]** *Veterinariya (Moscow) 46(1): 58-60; 1969.* (Russian)

Acute toxicities of trichlorometaphos-3 (a ronnel derivative), trichlorfon, and Trolene (ronnel) were studied in albino mice, chickens, and calves. The trichlorometaphos-3 doses fed to mice, chickens, and calves ranged from 100-600 mg/kg, 10-700 mg/kg, and 10-500 mg/kg. Trichlorfon doses of 300-900 mg/kg, 10-250 mg/kg, and 15-800 mg/kg were fed to mice, chickens, and calves; mice and calves were fed 100-1,500 mg/kg and 60 mg/kg doses of Trolene. Symptoms of poisoning were similar in the animals. Tachypnea, sialorrhea, lachrymation, motor depression and uncoordination, convulsions, diarrhea, loss of appetite, and finally asphyxiation were the principal symptoms of

poisoning. Leukocyte levels decreased, hemoglobin and erythrocyte levels increased as did erythrocyte sedimentation rate, and the lymphocyte, monocyte, and basophilic and eosinophilic cell counts decreased sharply. The blood cholinesterase activity was reduced to 21.5-38.3%, and even lower in later phases of the poisoning. Total protein, phosphorus, sodium and alkali reserves decreased after ingestion of 250 to 500 mg/kg doses. The LD50 values of trichlorometaphos-3 in albino mice, chickens, and calves were 414, 450, and 250-500 mg/kg. The corresponding LD50 values of trichlorfon were 650, 125, and 600 mg/kg. The LD50 value of Trolene in albino mice was 972 mg/kg.

73-1734. Borodulina, N. A.; Kvitkin, Yu. P. (Saratov Inst. Animal Husbandry Vet., Saratov, USSR). **O vozmozhnosti skarmlivaniya sobakam myasa zhivotnykh, otravlennyhk mysh'yakom. [On the possibility of feeding dogs with arsenic-poisoned animal meat.]** *Veterinariya (Moscow) 46(1): 97-98; 1969.* (Russian)

Toxic effects and dynamics of arsenic were studied in sodium arsenate-poisoned rabbits and in dogs fed arsenic-containing meat from the rabbits. Moderately plethoric liver with granulous focal dystrophy, circulatory troubles with intracapillary hemorrhagic and serous glomerulonephritis in the kidney, focal and diffuse hyperemia and hemorrhage with minor proliferative processes in the heart and lung, plethora of the red pulp and lymphoid type focal proliferation of the white pulp of the spleen, and focal and diffuse proliferation of lymphoid cells in the intestines were observed in rabbits fed a single 0.45 g dose of sodium arsenate per kg of body weight. The arsenic residue contents in the liver, muscles, and long bones were 3.37, 2.38, and 2.89 mg%. Dogs fed daily 250 g of rabbit meat containing 1.31 to 3.73 mg% of arsenic over 20 days developed no physiological and hematological changes.

73-1735. Mukhamedshin, R. A. (All-Union Sci. Res. Inst. Avian Pathol., Moscow, USSR). **Morfologicheskiye izmeneniya u kur pri otravlenii trolenom. [Trolene-generated morphological changes in chicken.]** *Veterinariya (Moscow) 47(7): 79-81; 1970.* (Russian)

Morphological changes in chickens fed single 0.03, 2.7, or 7.5 mg/kg doses of Trolene (ronnel) were studied. Chickens fed 0.3, 2.7, and 7.5 mg/kg/doses of Trolene died 1 to 3 days after poisoning while other groups fed 0.03 and 0.3 mg of Trolene per kg body weight survived up to 30 days. General symptoms included depression, hypersalivation, paresis and paralysis of the limbs, and coma. Focal necrosis with slight proliferation of the hepatocytes and venous stasis in the liver; focal necrosis in the liver, spleen, and brain; congestive hyperemia in the heart, mesencephalic and cardiac vessels and kidney; hemorrhages in the kidney, ovarian stroma, and brain were observed. Doses of Trolene that were not enough to produce clinical symptoms of poisoning caused general hemodynamic disorders and perivascular edema in the brain and lung. The findings indicate medium toxicity of Trolene to chicken.

73-1736. Stupnikov, A. A. (All-Union Sci. Res. Inst. Avian Pathol., Moscow, USSR). **O mekhanizme toksicheskogo deystviya gerbitsidov. [On the mechanism of toxic action of herbicides.]** *Veterinariya (Moscow) 49(7): 88-89; 1972.* (Russian)

The mechanism of the toxic action of different groups of herbicides was studied in plants and animals. The mechanism of action of 2,4-D, 2,4,5-T, and 2M-4C in animals is based upon interference with the function of the thyroid gland, reduction of the rate of alkaline metabolism, inhibition of oxidative processes, uncoupling of oxidative and phosphorylation processes, and a reduction in the adenosine triphosphate and creatine phosphate levels. Disturbances in the energetic and hormonal balances, dysfunction of the adrenal cortex, hypersecretion of glucocorticoids, reduced rate of mineral corticoid secretion, and changes in the activity of enzymes responsible for carbohydrate metabolism were determined. Phenol derivatives cause separation of oxidative and phosphorylation processes, stimulate tissue respiration, and interfere with adenosine triphosphate synthesis; acceleration of metabolic processes and thermal shock results. Carbamates in animals interfere with cell mitosis and may have teratogenic and blastomogenic effects. Carbamates inhibit cholinesterase, cytochrome oxidase, succinic dehydrogenase, and pyruvate dehydrogenase, and interfere with redox reaction, and carbohydrate and nucleic acid metabolism. Dalapon in animals interferes with pantothenic acid synthesis.

73-1737. Carricaburu, P.; Lacroix, R. (Fac. Mixte Med. Pharm., Algiers, Algeria). **Effet du parathion sur l'electroretinogramme de la souris blanche. [The effects of parathion on the electroretinogram in albino mice.]** *Vision Res. 13: 793-796; 1973.* (7 references) (French)

Electroretinograms of pentobarbital anesthetized albino mice were recorded following application of a drop of parathion on the ocular mucosa. Light stimulation was done by electronic flash; electroretinograms were recorded every five minutes without readaptation to light. Poisoning with parathion resulted in rapid suppression of the c-wave. At the same time increased latency and reduced amplitude of the b-wave until its complete disappearance occurred. The a-wave was the last to disappear from the electroretinogram. These alterations are due to synaptic disruption between visual cells and bipolar cells.

73-1738. Kuz'minskaya, U. A.; Klisenko, M. A.; Khaykina, B. I. (Lab. Biochem., All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastics, Kiev, USSR). **Osobennosti raspredeleniya nekotorykh pestitsidov v lipidnykh fraktsiyakh pecheni. [Peculiarities of the distribution of some pesticides in the lipid fractions of the liver.]** *Vop. Pitan. 31(5): 48-52; 1972.* (16 references) (Russian)

The distribution of DDT and carbaryl was studied in liver lipid fractions of albino rats previously fed DDT

or carbaryl. The lipid fractions were isolated from the liver lipid extract by thin-layer chromatography. Lipid fractions from rats fed 70 mg of DDT per kg of body weight for three days contained DDT, DDD (TDE), and DDE in free form and within the cholesterol ester fraction. After daily administration of 3.5 mg of DDT per kg for five months, DDT and its metabolites formed part of all lipid fractions (phospholipids, free cholesterol, triglycerides, and cholesterol esters), with preferential accumulation of DDT in the cholesterol esters, of DDD in the latter and in triglycerides; negligible amounts were in free form. Carbaryl, administered to white rats at 144 mg/kg for three days, was found both in free form and in the phospholipid and triglyceride fractions. Traces of carbaryl were found in the same fractions after it was administered to the animals in daily 7.2 mg/kg doses for five months. The observed differences in the incorporation of DDT and carbaryl liver lipid fractions may be attributed to differences in the structure and cumulative ability of these compounds.

73-1739. Shtenberg, A. I.; Dikiy, V. V. (Lab. Pestic. Toxicol., Inst. Nutrition, U.S.S.R. Acad. Med. Sci. Moscow, USSR). **Izmeneniya v metabolizme DDT, deponirovannom v sal'nike belykh krys, pri golodanii. [Changes in the metabolism of DDT deposited in the omentum of fasting albino rats.]** *Vop. Pitan. 32(1): 39-43; 1973.* (5 references) (Russian)

The dynamics and metabolism of DDT depots were studied in the omentum of albino rats fed 1/2,000 and 1/20 of LD50) for 6 months and 30 days, and fasting consecutively for 12 and 6 days. The DDT, DDE, and DDD (TDE) contents in the omentum of the groups fed 1/2000 and 1/20 LD50 were 1.85, 0.39, and 0.15 mg/kg and 51.4, 8.49, and 3.26 mg/kg; the corresponding values for a control group were 0.27, 0.07, and 0.37 mg/kg. Fasting for 12 days increased the DDT and DDT metabolite level in the omentum of the control group, and in the group fed 1/2,000 LD50, as opposed to groups not fasted. The increase in the DDT and DDT metabolite levels of the omentum was relative since it occurred at the expense of reduced size of the omentum. A 6 day long fasting in the group fed 1/20 of LD50 for 30 days resulted in a drastic drop in the DDT and DDT metabolite levels. The reduced rate of metabolism observed in animals with high levels of DDT and DDT metabolites in the omentum during fasting may be due to the toxic effect of large quantities of DDT on enzymes responsible for DDT metabolism.

73-1740. Perelygin, V. M.; Shpirt, M. B.; Genis, V. I. (Lab. Toxicol., Kirghiz Inst. Epidemiol. Microbiol. Hyg., Frunze, USSR). **K voprosu o tsitotoksichnosti pestitsidov pri ikh sovmestnom deystvii. [Cytotoxicity of pesticides in combined action.]** *Vop. Pitan. 32(1): 44-47; 1973.* (15 references) (Russian)

Health hazards of pesticides were assessed with special regard to the situation prevailing in the Kirghiz SSR. The cytotoxic effects of practically occurring concentrations of metaphos (methyl parathion), methyl mercaptophos, trichlorfon, phosphamide (dimethoate), Sevin (carbaryl), DDT, hexachlorane (BHC) and their combinations were studied in fibroblastoid cell cultures from human embryos. Methyl mercaptophos, metaphos, and Sevin were the dominant pesticides used in the Kirghiz SSR and animal food products and human milk were mainly contaminated with organochlorine pesticides. Fibroblastoid cells cultured for 168 to 192 hr with 0.004 mg of metaphos, 0.005 mg of methyl mercaptophos, 0.0018 mg of trichlorfon, 0.0003 mg of phosphamide, 0.0006 mg of Sevin, 0.0042 mg of DDT, 0.0015 mg of hexachlorane, or a combination of these seven pesticides, as well as with a mixture of 0.0249 mg of DDT with 0.0105 mg of hexachlorane per kg (the latter corresponding to the weekly intake) had degeneration indices of 28.1, 25, 25, 25, 25, 27.1, 25.3, 37.4, and 34.4% versus a control value of 21.9%. The degeneration indices determined for the combinations of seven pesticides and of DDT with hexachlorane were statistically significant.

See also **73-1526** **73-1563** **73-1567** **73-1568** **73-1592** **73-1599**

73-1741. Von Storp, L. H.; Guilbault, G. G. (Dept. Chem. Louisiana State Univ., New Orleans, LA 70122). **A new assay for cholinesterase potentiometric determinations in flow streams.** *Anal. Chim. Acta 62(2): 425-430; 1972.* (13 references)

A sensitive and accurate method for the continuous assay of ChE was developed. The method depends on the potentiometric response at a sulfide electrode produced by thiocholine. Silver sulfide-silver iodide salts in a ratio of 10:1 were pressed into pellets to make thiocholine-sensitive membranes. An enzyme solution was introduced into the acetylthiocholine chloride (ATCCl) via a mixing chamber after the first electrode and passed through a delay coil, which permitted a one minute reaction time, and then to the indicating electrode. Under optimum conditions (substrate concentration of $2 \times 10^{-3} M$ ATC, 0.5*M*, phosphate buffer between pH 7 and pH 7.5 and a temperature of 36°) the potential difference was directly proportional to enzyme concentration and exponentially proportional at higher enzyme contents. The limit of detection was 0.002 units, and sensitivity could be improved by increasing the reaction time of ATCCl hydrolysis. Aside from a rather long response time (3-4 minutes) the method compares well with other spectrophotometric and fluorometric methods and can be automated.

73-1742 Weber, R.; Wollenberg, H.; Drossel, C. (Landesanst. Lebensm.-u. Gerichtl. Chem., Berlin, Germany). **Die Sicherung des gaschromatographischen Nachweises von Hexachlorbenzol (HCB) durch Derivatbildung. [Confirmation of gas-chromatographic detection of HCB by derivative formation.]** *Arch. Lebensmittelhyg. 24(1): 11-13; 1973.* (3 references) (German)

Derivatization of HCB was used to eliminate errors, due mostly to the presence of lindane, in the gas chromatographic determination of HCB residues in meat products. The HCB derivatives were identified by mass spectrometry and utilized for the positive identification of HCB in cases where several unidentified peaks appeared in the chromatogram. Meat samples were extracted with petroleum ether and cleaned up on Florisil. The solvent was evaporated; part of the sample was combined with potassium phenolate in dimethylsulfoxide, and allowed to react for 90 min at 60-65°C. The derivatives obtained were mono-, di- and trisubstituted pentachlorophenylphenylethers. These products were separated by gas chromatography and used to analyze and determine HCB with a high reliability.

73-1743. Beyer, K. H.; Bothe, W. (Pharmazeutisches Inst. der Freien Univ. Berlin, und Landesanstalt fuer Lebensmittel-, Arzneimittel- und gerichtliche Chemie Berlin, Berlin, Germany). **Die quantitative Bestimmung des Diquat in biologischem Material. [The quantitative determination of diquat in biological material.]** *Arch. Toxikol. 30: 111-114; 1973.* (4 references) (German)

Permutit R S 40, an acid ion exchange resin, can be used to determine the herbicide diquat. This compound is eluted by the ion exchange column with a cold saturated NH_4Cl solution. The spectrophotometric determination is carried through after reduction to a green colored radical. (Author abstract by permission)

73-1744. Takiura, K.; Yamaji, A.; Oe, M.; Yuki, H. (Osaka Univ. Fac. of Pharmaceutical Sci., Osaka, Japan). **[Analysis of commercial mosquito coil smoke by gas chromatography.]** *Bochu Kagaku (Sci. Pest Contr.) 38(1): 26-29; 1973.* (12 references) (Japanese)

Smoke from slowly burning commercial mosquito coils was analyzed by gas chromatography to determine its components. A gas chromatograph with a hydrogen flame detector was used. From the peaks of the gas chromatogram acetaldehyde, furan, propionaldehyde, acetone, acrolein, benzene, toluene, xylene, and styrene were identified, using 25% PEG 6000 on a celite 545 packed column, 2600 mm in length and 3 mm in diameter. The compounds are considered to be the pyrolysis products derived from the basic materials (the carrier) of the mosquito coils. There were no differences between three different coils, each made by different formulators, concerning basic materials. By using a column containing 3% SE 30 on chromosorb W (60-80 mesh) at 210°, insecticidal constituents such as allethrin and pyrethrin I were identified in the smoke. Large amounts of allethrin and pyrethrin I and very small quantities of cinerin I, cinerin II, and pyrethrin II were identified by extracting and gas-chromatographing one of the coils. However, only two components, allethrin and pyrethrin, were detected in its smoke. The other two coils emitted allethrin alone.

73-1745. Levi, I.; Nowicki, T. W. (Grain Res. Lab., Canadian Grain Commission, Winnipeg, Canada). **Fritted disc funnels and tapered stainless steel tubes and stoppers for use in pesticide residue analysis.** *Bull. Environ. Contam. Toxicol. 9(1): 20-23; 1973.* (1 reference)

A fritted disc funnel was designed for use in suction-filtering extracted pesticide residue samples. The funnel was shown to be free of materials interfering in GC analysis when concentrated hexane washings gave no GC peaks. An all stainless steel tapered tube and stopper assembly was designed to eliminate interfering peaks caused by gaskets in extracter-blender apparatus. Both innovations have been used daily for six months with completely satisfactory results. When oats and rye were analyzed, it was necessary to cover the fritted disc of the funnel with a layer of 3/8 inch of ignited Celite 545 because of the high gum and ..oer contents.

73-1746. Serat, W. F.; Mengle, D. C. (Community Studies on Pesticides, Dept. Pub. Health, Berkeley, CA 94704). **Quality control in the measurement of blood**

cholinesterase activities among persons exposed to pesticides. *Bull. Environ. Contam. Toxicol. 9(1): 24-27; 1973.* (1 reference)

A comparison of intra- and interlaboratory blood ChE determinations illustrates the need for a program of "quality control." Enzyme activities for samples of bovine plasma ChE (assayed twice by the pH-stat technique by the same personnel in the same laboratory and with reagents from the same source) differed by an average of more than 5% when different instruments of comparable function were employed. When the same samples of human blood were analyzed for ChE activity by the pH-stat method with instruments of the same manufacturer in two different laboratories, strikingly different results were obtained although a high degree of precision was observed in both laboratories. The same method used by four different laboratories yielded up to 2-fold differences in values for bovine serum ChE activity. Similar discrepancies can be expected with other ChE assays, making them unreliable for comparison of results from different laboratories, legal decisions, and monitoring of pesticide exposure.

73-1747. Deubert, K. H.; Timmerman, J. S.; McCloskey, L. R.* (Dept. Biol., Walla Walla College, College Place, WA 99324). **Effects of fixation on the extraction of dieldrin and *p,p'*-DDT from muscle tissue.** *Bull. Environ. Contam. Toxicol. 9(1): 54-56; 1973.* (3 references)

The use of formalin or Bouin's mixture as tissue fixatives did not appear to affect the extractability of *p,p'*-DDT and dieldrin at environmental levels in samples of fish muscle tissue. Frozen tissue served as a reference. Variations in results were observed, but were attributed to low concentrations and the fact that sections of tissue rather than aliquots of homogenates were used for assay. The results indicate that tissue samples fixed in Bouin's solution for histological studies could be used for dieldrin and DDT analysis; when freezing of samples for residue analysis is not possible, these fixatives could be used.

73-1748. Baird, R. B.; Carmona, I. G.; Kuo, C. L. (County Sanitation Districts of Los Angeles County, Whittier, CA 90601). **Gas-liquid chromatographic separation of sulfur from chlorinated pesticide residues in wastewater samples.** *Bull. Environ. Contam. Toxicol. 9(2): 108-115; 1973.* (8 references)

A satisfactory GC procedure has been devised for quantitating organochlorines. The procedure alleviates the sulfur interference problem, but does not add significantly to the time required for assay. A mixture of 4.4% OV-17, 4.7 % QF-1, and 1.0% DC-200 on 80/100 mesh Gas-Chrom Q solid support was used for the column packing materials. Separate portions of support material were coated with each liquid phase and the individually coated portions combined before packing. Chromatographs equipped with electron capture detectors (Ni^{63}) were used. The major interfering sulfur peak appeared between the *o,p'*-DDE and *p,p'*-DDE peaks, eliminating sulfur interference with the analysis of these compounds without diminishing resolution of other pesticides being assayed. Waste waters and sediments were analyzed without lengthy chemical desulfurization or large scale extractions and determinations made with highly selective detectors.

73-1749. Schulten, H. R.; Prinz, H.; Beckey, H. D.; Tomberg, W.; Klein, W.; Korte, F. (Inst. Phys. Chem., Bonn Univ., Bonn, Germany). **Felddesorptions-Massenspektrometrie. Eine neue Methode zur Identifizierung von Pestiziden und deren Metaboliten. [Field desorption mass spectrometry: a new method for identification of pesticides and their metabolites.]** *Chemosphere 2(1): 23-30; 1973.* (11 references) (German)

Field desorption mass spectrometry and its use for the identification of chlordene, kelevan, and their metabolites (1-hydroxychlordene and kelevan acid) are described. The sample to be investigated was applied on an emitter (10 μ tungsten wire) which was then placed into an ion source for desorption of the substance in a high-intensity electrical field of 1,000,000 V/cm. The ions thus released were recorded by a conventional mass spectrometer. Electron impact mass spectra were recorded at an ion source temperature of 250°C, an electron energy of 70 eV, and a pressure of 1×10^{-7} mm Hg. Comparison of electron impact spectra with field desorption spectra of chlordene, kelevan, and their metabolites revealed much higher relative intensities of molecular ion peaks in the field desorption spectra, even for highly polar decomposition products. Increased fragmentation, useful for structural analysis, can be induced thermally by increasing the emitter current.

73-1750. Franken, J. J.; Vader, H. L. (Dept. Instrumental Anal., Eindhoven Univ. Technol., The Netherlands). **Open hole tubular columns in pesticide analysis.** *Chromatographia 6(1): 22-27; 1973.* (9 references)

The use of capillary columns with electron capture GC was suitable for analysis of organochlorine pesticides. A special connection consisting of a tapered glass insert and shrinkable teflon tubing was devised so that samples could be directly injected onto the column. To overcome problems associated with flow a stainless steel capillary was introduced which led the effluent to a point very near the measuring cell of the detector. Pesticides could be determined in the picogram range and biological materials were tested. The limit of detection of lindane was < 0.1 pg.

73-1751. Coha, F. (INEP, Inst. Pestic., Belgrade, Zemun, Yugoslavia). **New possibilities in applying some analytical methods for semi-quantitative determination**

of pesticides. *Contemp. Agr. (Savremena Poljoprivreda) 19(5): 71-75; 1971.* (13 references)

Semi-quantitative methods for determining five herbicides belonging to different chemical classes were investigated. Thin layer chromatography on silica gel G was suitable when different solvent systems were used for the different herbicides. Sensitivities of the herbicides to indicator solutions used in conjunction with TLC were 0.25 μg for amiben; 0.750 μg for CDAA; 0.500 μg for diquat; and 1.000 μg for paraquat. Sensitivities to the same reagents for these compounds using the "ring-oven" technique were in the same range. A combination of the two techniques provides a simple, quick, inexpensive procedure for the detection, identification, and determination of micro-quantities of some herbicides.

73-1752. Kumar, R. (Univ. of Wyoming, Laramie, WY). **Bioassay of cyolane and cytrolane residues in alfalfa hay.** *Diss. Abstr. Int. 33(1): 250B-251B; 1972.*

A bioassay method was developed for determining residues of cyolane and cytrolane in alfalfa hay following field application in different climates. The sensitivity of mosquito larvae, house flies, and pomace flies to the insecticides was compared; mosquito larvae, being most sensitive, were selected as the assay organisms. Mortality counts were recorded after 24 hours of continuous exposure to residues extracted from alfalfa samples. Results were compared with standard dosage-mortality curves. The mosquito larvae were slightly but not significantly more sensitive to cytrolane than cyolane. The results obtained indicated comparatively higher concentrations (lower rate of degradation) of residues in the Laramie, Wyoming, samples than in the Torrington samples, probably due to climatic conditions. Residue concentrations were less than 1 ppm after 7 and 14 days of treatment with 1/2-1 lb per acre at Torrington and Laramie respectively. The alfalfa samples were air-dried and ground before extraction. Extraction gave 88% recovery for both cytrolane and cyolane. The bioassay method detected as little as 0.1 ppm of cytrolane and cyolane, while gas chromatography could detect only 0.05 ppm. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-13,037.)

73-1753. Yermakov, V. V. (Author address not given). **Gazokhromatograficheskiye metody opredeleniya pestitsidov v biologicheskikh ob"yektakh. [Gas chromatographic methods for determination of pesticides in biological substrates.]** *Izd.-vo Nauka, Moscow, 1972. 168 p.* (460 references) (Russian)

Theory and practice of the extraction and purification of biological samples for gas chromatographic determination of pesticide residues and the gas chromatographic determination technique used are reviewed. High sensitivity and the possibility of the simultaneous qualitative and quantitative determination of pesticides and their metabolites are the basic advantages involved in gas chromatographic methods. Nothwithstanding, the quantitative procedures currently applied need further improvements, especially for residues in the ng range where interferences due to impurities become significant. Combinations of gas chromatography with mass spectrometry are highly valuable especially when chromatographic peaks overlap each other and in the determination of organochlorine pesticides. The significance of the use of electron capture, thermionic, and flame photometric detectors is emphasized. Flame photometric detectors are particularly suitable for the determination of compounds containing selenium, tellurium, silicon, arsenic, phosphorus, and sulfur. Chromatographic column parameters for the determination of various pesticides are listed.

73-1754. Klisenko, M. A.; Verblyudova, N. I. (All-Union Res. Inst. of Hyg. and Toxicol. Pestic., Polymers and Plastics, Kiev, USSR). **A specific method for determination of polychloropinene in biological material.** *Hyg. Sanit. 36(7/9): 88-91; 1971.* (1 reference)

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(7): 72-75; 1971, see Abstract no. 72-1098.

73-1755. Klisenko, M. A.; Pis'mennaya, M. V. (All-Union Res. Inst. of Hyg. and Toxicol. of Pestic., Polymers and Plastics, Kiev, USSR). **Determination of "Saiphos" (menazon) in air by thin layer chromatography.** *Hyg. Sanit. 36(7/9): 252-254; 1971.* (4 references)

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(8): 72-74; 1971, see Abstract no. 72-1099.

73-1756. Vengerskaya, Kh. Ya.; Demidenko, N. M.; Mayorova, T. N.; Izmaylova, G. D. (Tashkent Forensic Sci. Res. Inst., Tashkent Med. Inst., USSR). **Determination of certain defoliants in air.** *Hyg. Sanit. 36(7/9): 301-302; 1971.*

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(8): 109-110; 1971, see Abstract no. 72-1100.

73-1757. Shmigidina, A. M. (All-Union Res. Inst. Hyg. Toxicol. Pestic., Polymers and Plastics, Kiev, USSR). **Detection of nitrophenol pesticides in thin-layer chromatograms.** *Hyg. Sanit. 36(7/9): 421-422; 1971.* (3 references)

English translation; for an abstract of the original Russian article, *Gig. Sanit.* 36(9): 77-78; 1971, see Abstract no. 72-0406.

73-1758. Caswell, R. L. (Criteria and Eval. Div., Office of Pestic. Programs, Environ. Protect. Agency, Washington, DC 20250). **Report on pesticide formulations.** *J. Ass. Offic. Anal. Chem. 56(2): 253-256; 1973.*

Representatives of the AOAC attended the 16th meeting of the Collaborative International Pesticides Analytical Council (CIPAC), aimed at attaining international cooperation in pesticide analysis. AOAC methods were reported to be inadequate for analysis of certain technical malathion products manufactured overseas. Collaborative studies were performed on the previously presented copper colorimetric method and the silver titration method for malathion; both gave acceptable results. Since these methods are not sufficiently specific for use on all products, a gas chromatographic method has been developed and will be studied. Methods were presented or further studied for analysis of aldicarb, allethrin, ametryne (and related compounds), carbaryl, chlordane, Karathane (and Kelthane), fertilizer-pesticide mixtures, herbicides, mercurials (in the presence of organochlorines), thiocarbamates, methoxychlor, trifluralin, and Balan. (Report of general referee presented at the 86th Annual Meeting of the AOAC, Oct. 9-12, 1972, at Washington, DC).

73-1759. Storherr, R. W. (Pestic. Tolerances Div., Environ. Protect. Agency, Washington, DC 20250). **Report on carbamate pesticides, fumigants, and miscellaneous.** *J. Ass. Offic. Anal. Chem. 56(2): 296; 1973.*

Associate referees on the topic of carbamate pesticides reported a variety of improved methods during the past year. The associate referee for determinative steps reported on a silylation method. The associate referee on general residue methods finished development of the method using the 2,4-dinitrophenyl ether derivatives of the methyl carbamates. The collaborative study on cyanide analysis yielded mixed results. The method, which uses a polarographic determinative step, worked well for nonfatty foods such as wheat and rice but gave problems with fatty foods such as spices. Appointment of associate referees to study analytical methods for ethylene oxide and ethylene chlorohydrin, fumigants, nicotine, and phostoxin is recommended. (Report of general referee presented at the 86th Annual Meeting of the AOAC, Oct. 9-12, 1972, at Washington, DC).

73-1760. Burke, J. A. (Div. of Chem. and Physics, Food and Drug Admin., Washington, DC 20204). **Report on chlorinated pesticides.** *J. Ass. Offic. Anal. Chem. 56(2): 296-299; 1973.*

Eight associate referees for chlorinated pesticides reported on the progress of their work. The associate referee on multiple pesticide residues in soil reported that prolonged shaking of a moist soil sample with hexane-acetone (1:1) was the most effective method for extraction of organochlorines. The associate referee on perthane concluded that perthane, heptachlor epoxide, dieldrin, and mirex can be determined in fruit and vegetable samples using the AOAC multiresidue method. Perthane was also determined in butterfat. The determination of perthane as the olefin after treatment with alkali was effective for both quantitation and identity confirmation. A collaborative study plan was formulated for tetradifon, endosulfan, and tetrasul in fruits, vegetables, and butterfat. The method will include the acetonitrile extraction and GLC determination of AOAC multiresidue methodology and a Florisil column chromatographic cleanup. The problem of inaccurate or questionable residue data generated by inexperience or incompetent application of analytical methodology was discussed. Use of a proven analytical method does not in itself assure that the resultant data are valid. The two most common obvious problems are the use of gas chromatographic systems which are not operating at acceptable levels of performance and the inept evaluation of gas chromatographic records. (Report of general referee presented at the 86th Annual Meeting of the AOAC, Oct. 12, 1972, at Washington, DC).

73-1761. Yip, G. (Div. Chem. Technol., Food and Drug Admin., Washington, DC 20204). **Report on fungicides, herbicides, and plant growth regulators.** *J. Ass. Offic. Anal. Chem. 56(2): 299-300; 1973.* (7 references)

Consolidation of methods for analysis of more compounds per method appears to be supplanting the proliferation of methods for established compounds. New methods reported include a TLC procedure for n-dodine in water, and application of a previously described colorimetric procedure to the detection of *o*-phenylphenol in citrus fruits. Two TLC procedures were developed as multiresidue methods for crops and for soil and water. Both procedures detect acidic and non-acidic herbicides. Electron-capture gas chromatographic methods were developed for barban and carbetamide, as well as the principal metabolite of each. An improved colorimetric method for CIPC (chlorpropham) residues in alfalfa using the Bleidner apparatus extended the sensitivity range to 0.02 ppm. Studies are underway on methods for determining ethylene thiourea, chlorophenoxy alkyl acids, dalapon, maleic hydrazide, and diquat/paraquat. Study on gibberellins was suspended. (Report of general referee presented at the 86th Annual Meeting of the AOAC, Oct. 9-12, 1972, at Washington, DC).

73-1762. Corneliussen, P. E. (Food and Drug Admin., 5600 Fishers Lane, Rockville, MD 20852). **Report on multiresidue methods (interlaboratory studies).** *J. Ass. Offic. Anal. Chem. 56(2): 302-303; 1973.*

Collaborative studies were conducted or initiated on several topics in the multiresidue area. A collaborative study of polychlorinated biphenyl (PCB) analysis using the existing AOAC multiresidue method is in progress. Artificially or environmentally contaminated

chicken fat and fish samples were subjected to a published silicic acid procedure for separating PCB and DDT analogs. A collaborative study of the sweep codistillation method for organophosphates in nonfatty foods is being initiated. Further study is recommended due to the variability of results from the study of multiresidue methods for whole blood. Whole blood samples spiked with lindane, dieldrin, and *p,p'*-DDT were treated with sulfuric acid, extracted with hexane-acetone, and the pesticides determined by GLC in this study. Several new techniques are under investigation in the multiresidue methods for total diet samples. These include an automated gel permeation technique and an elution solvent system for Florisil column cleanup. The dry ashing procedure in the multiresidue method for heavy metals in foods allowed recovery of 8 metals from fish. The use of an alkaline precolumn seems to offer increased specificity in GLC determinations of organochlorine mixtures. (Report of general referee presented at the 86th Annual Meeting of the AOAC, Oct. 9-12, 1972, at Washington, DC).

73-1763. McCully, K. A. (Health Protect. Branch, Dept. of Nat. Health and Welfare, Ottawa, Ont., Canada K1A 1B7). **Report on phosphated pesticides.** *J. Ass. Offic. Anal. Chem. 56(2): 303-305; 1973.* (10 references)

Achievements in determination of organophosphorus pesticides during the past year are reviewed. Methods for determining residues of individual organophosphates were published during the year. Studies were performed on uniformity of Florisil lots; solvents for elution of organophosphates from Florisil; separation of pesticides into groups on silica gel microcolumns for GLC identification; and application of sweep codistillation to organophosphates. A procedure was developed for cleaning up extracts from 100 g nonfatty food samples so that the total cleaned up extact can be spotted on a TLC plate. Cleanup comprises percolation of the extract through a granular charcoal column with an ethyl acetate-methylene chloride-benzene (1:1:1) solvent system; a second cleanup on alumina column with elution by acetone (20%) in isooctane; and partitioning between isooctane and acetonitrile. An automatic spotter and fiber optic reflectance scanner for TLC plates are now commercially available. (Report of General Referee presented at the 86th Annual Meeting of the AOAC, Oct. 9-12, 1972, at Washington, DC).

73-1764. Laski, R. R.; Watts, R. R.* (Pestic. Tolerances Div., Environmental Protection Agency, Washington, DC 20406). **Gas chromatography of organonitrogen pesticides, using a nitrogen-specific detection system.** *J. Ass. Offic. Anal. Chem. 56(2): 328-332; 1973.* (14 references)

A gas-liquid chromatographic system with a nitrogen-specific detector was investigated for the determination of 95 organonitrogen pesticides. Each compound was chromatographed, using DC-200 liquid phase on a solid support of 80-100 mesh Chromosorb W (HP). Retention times and response data are given for these pesticides. (Author abstract by permission)

73-1765. Haines, L. D.; Adler, I. L. (Research Lab., Rohm and Haas Co., P.O. Box 219, Bristol, PA 19007). **Gas chromatographic determination of ethylene thiourea residues.** *J. Ass. Offic. Anal. Chem. 56(2): 333-337; 1973.* (8 references)

Residues of ethylene thiourea on food crops are determined by extracting the sample with methanol, partially purifying the extract on an alumina column, and derivatizing the ethylene thiourea extracted with 1-bromobutane in the presence of dimethylformamide and sodium borohydride. The resulting derivative is measured by gas chromatography, using a flame photometric detector. The method is suitable for routine use and is sensitive to 0.01 ppm. (Author abstract by permission)

73-1766. Joiner, R. L.; Baetcke, K. P. (Biochem. Dept., Miss. Agr. and Forestry Exp. Sta., Mississippi State Univ., State College, MS 39762). **Comparative studies of thin layer chromatographic systems for the separation and identification of photoalteration products of parathion.** *J. Ass. Offic. Anal. Chem. 56(2): 338-340; 1973.* (27 references)

Twelve thin layer chromatographic systems were compared for the separation of photoalteration products of parathion. *Rf* values for each component in each system are presented. Infrared spectra confirmed the identity of separated components. The following 4 systems were designated superior and gave excellent separation of the components: petroleum ether-ethyl ether-glacial acetic acid (80+15+5 and 50+45+5), methanol-chloroform-ammonium hydroxide (24+75+3.5), and methanol-chloroform-petroleum ether (10+20+70). (Author abstract by permission)

73-1767. Stalling, D. L.; Huckins, J. N. (Fish-Pesticide Res. Lab., Bureau of Sport Fisheries and Wildl., Columbia, MO 65201). **Reverse phase thin layer chromatography of some Aroclors, Halowaxes, and pesticides.** *J. Ass. Offic. Anal. Chem. 56(2): 367-372; 1973.* (7 references)

The components of Aroclor 1232, 1248, 1254, and 1260; Halowaxes 1099, 1013, and 1014; and several chlorinated pesticides are resolved by reverse phase thin layer chromatography (RPTLC), which permits component separation by partition between a nonpolar stationary phase and a polar mobile phase. *Rf* values of resulting spots were calculated for two of four new solvent systems (mobile phases). RPTLC patterns were reproducible and characteristic of each material examined. The spots were recovered from the plates and charac-

terized by gas-liquid chromatography (GLC) and and/or GLC-mass spectrometry. In some cases single GLC peaks of Aroclor standards were resolved into more than one component by RPTLC, whereas some RPTLC spots of Halowaxes were resolved into as many as four GLC peaks. The analysis of environmental residues of chlorinated compounds was facilitated by this technique. (Author abstract by permission)

73-1768. Abbas, S. L.; Ghosh, A.K.; Rizvi, S. A. I.; Saxena, O. C. (Dept. of Agron., Allahabad Inst., Allahabad, India). **Direct titrimetric microdetermination of fluorodifen, linuron, faneron, and pebulate.** *J. Ass. Offic. Anal. Chem. 56(2): 387-389; 1973.*

The herbicides fluorodifen, linuron, faneron, and pebulate have been determined in individual standard solutions by direct titration against gallium chloride solution, using different indicators. The same technique is applied to estimation of these herbicides in treated soils. The complex between gallium chloride and fluorodifen or linuron is formed in a 1:3 ratio, whereas the complex with faneron or pebulate is in a 1:1 ratio. Recoveries for fluorodifen, linuron, faneron, and pebulate were 99.9-101.5, 99.0-102.4, 97.1-101.3, and 98.3-101.2%, respectively. Treatment with herbicide lowered the pH of the soil. (Author abstract by permission)

73-1769. Thomas, R. F. (Technical Service Div., Office of Pesticide Programs, Environmental Protection Agency, Beltsville, MD 20705). **Residues of lindane on food and utensils from a thermal lindane vaporizer.** *J. Ass. Offic. Anal. Chem. 56(2): 389-391; 1973.* (3 references)

Food products and utensils were exposed to a thermal lindane vaporizer. The food products exposed showed residues from <0.01 to 0.61 ppm lindane. Exposed utensils showed residues of 0.01-6.00 μg per object. Air samples taken during the test showed up to 0.018 μg lindane/l. after five days of vaporizer operation. Samples of various foodstuffs and utensils were taken daily, then frozen until analyzed. Room air was sampled with an air pump and impinger. After passing 200 l. of air through the impinger containing ethyl alcohol, the alcohol was diluted to a definite volume and an aliquot subjected to gas chromatography. The utensils were washed with hexane and an aliquot of the wash subjected to electron capture gas chromatography. Thin layer chromatography and microcoulometric gas chromatography were used as confirmatory procedures. (Author abstract by permission, supplemented.)

73-1770. Kosinkiewicz, B.; Lubczynska, J. (Agr. Univ. of Wroclaw, Inst. of Applied Biol., Wroclaw, Poland). **A method for the determination of Venzar (3-cyclohexyl-5,6-trimethyluracil) on silica gel layers.** *J. Chromatogr. 74(2): 366-368; 1972.* (5 references)

Determination of Venzar has been difficult in the past due to a lack of specific reaction of this stable compound. In the present method, aqueous solutions of Venzar are extracted with ethyl acetate, the extracts evaporated to dryness, and the residue redissolved in ethyl acetate. A 0.15 ml volume of the sample is placed on an activated silica gel plate and the plate developed with ethyl acetate-benzene. After development the plates are sprayed with concentrated sulfuric acid and placed in a drying box. Another plate covered with the same gel is sprayed with a 0.5% solution of rutine in 96% ethanol and placed in the drying box. The door of the drying box is opened after 10 min. After an additional 10 min, bright yellow spots appear at *Rf* 0.48 on the plates containing Venzar. After cooling, the plate is observed under a UV lamp. The fluorescent yellow-green spots are transferred to test tubes with 5 ml of 96% ethanol, and after standing for 10 min with periodic stirring the supernatant is filtered off and the extinction read at 270 nm. A linear extinction curve was obtained for 0.03-0.12 mg Venzar. The error of the method is about 10%, and the limit of detection is 0.10 mg per spot. The color, once formed, is stable for a few hours.

73-1771. Bloom, P. J. (Lab. de Bromatol., Univ. de Liege, 4000 Liege, Belgium). **Application des chromatographies sur couche mince et gaz-liquide a l'analyse qualitative et quantitative des esters des acides phosphorique et phosphoreux. [Application of thin-layer and gas-liquid chromatography to qualitative and quantitative analysis of phosphoric and phosphorous esters.]** *J. Chromatogr. 75(2): 261-269; 1973.* (19 references) (French)

A method for the qualitative and quantitative analysis of several phosphoric and phosphorous esters is described. Thin-layer chromatography is only a qualitative method and requires two solvents to distinguish the majority of these esters efficiently, whereas gas-liquid chromatography permits the qualitative analysis of a mixture of esters with a good resolution. However, some separations may be obtained by coupling gas-liquid chromatography and thin-layer chromatography. The quantitative analysis is possible with a 6σ resolution. (Author abstract by permission)

73-1772. Lamotte, A.; Viricel, M. (Lab. de Chimie Anal. I, Univ. de Lyon I, 69-Villeurbanne, France). **Relations entre solute, solvant et adsorbant en chromatographie sur couche minces. III. Relation entre la structure moleculaire du solvant et la migration du solute sur l'adsorbant. Application a la chromatographie des organophosphores neutres. [Relationships between the solute, solvent, and adsorbent in thin-layer chromatography. III. Relationship between the molecular structure of the solvent and the migration of the solute on the layer. Application to the chromatography of neutral organophosphorus compounds.]** *J. Chromatogr. 76(2): 381-392; 1973.* (20 references) (French)

In view of the fact that solvents can be either hydrogen-bond acceptors or hydrogen-bond donors, some simple chromatographic processes may be schematized. This possibility has been utilized in the chromatography of organophosphorus compounds on silica gel using various solvent systems. The information obtained on solute-solvent, adsorbent-solvent, and adsorbent-solute interactions has opened the way for a rapid choice of the most suitable adsorbent and solvent in a given case. (Author abstract by permission)

73-1773. Van der Velden, H.; Jaeger, A. J. (Food Inspection Service, Nieuwegracht 3, Haarlem, The Netherlands). **Modern methods of pesticide residue analysis.** *Mitt. Geb. Lebensmittelunters. Hyg. 63(1): 153-160; 1972.* (8 references)

Methods of pesticide residue analysis were surveyed in the United Kingdom where pesticide control has been operating rather successfully on a voluntary basis. The laboratory of the government chemist has made several interesting contributions in the field of determination of pesticide classes such as organophosphates, ureas and carbamates, and organochlorines, and individual members of a class. Confirmation of organochlorine residues is achieved through GC (using three columns of different polarity), TLC, chemical reactions, and IR spectrophotometry although the latter requires expensive equipment. Column chromatography is used to separate polychlorinated biphenyls which generally interfere with tissue analyses for organochlorines. Thermionic detector GC is used by the laboratory for confirmation of organophosphates. At the Huntington Research Center flame photometric GC, which requires less clean-up, is used for organophosphate and organosulfur pesticides. Each method used by the various laboratories has its advantages and disadvantages.

73-1774. Vogel, J.; Corvi, C.; Veyrat, G. (Author address not given). **Dosage des residus de "Benomyl" par chromatographie sur couche mince. [Determination of benomyl residues by thin-layer chromatography.]** *Mitt. Geb. Lebensmittelunters. Hyg. 63(3): 453-456; 1972.* (3 references) (French)

A specific thin-layer chromatographic method for the routine determination of benomyl and its principal metabolite in fruits and vegetables is described. Benomyl and its metabolites are extracted by means of ethyl acetate. The purified extract is hydrolyzed to 2-aminobenzimidazole. Development in a cuvette is done by means of a mixture of hexane, ethyl acetate, and methanol. Bromine vapor is used for visualization. Vegetable extracts do not interfere with the determination. The detection limit is 0.2 ppm of benomyl.

73-1775. Samosvat, L. S.; Voinova, I. V. (Dept. Hyg. Toxicol. Clin. Pesticides, Kiev Inst. Postgrad. Med., Kiev, USSR). **K metodike opredeleniya ostatochnykh kolichestv gerbitsidov i ikh metabolitov v produktakh pitaniya posredstvom tonkosloynoy khromatografii. [Contribution to the determination of residues of herbicides and their metabolites in food products by thin-layer chromatography.]** *Vop. Pitan. 32(1): 77-78; 1973.* (2 references) (Russian)

A thin-layer chromatographic method is described for the determination of metabolites of propanide (propanil) in fish, fish fat and tomato, of solan in carrot and tomato, of dicryl in cucumber and carrot, and of Amiben (chloramben) in cabbage, tomato, and carrot. Samples of tomato and cucumber are treated with anhydrous sodium sulfate and chloroform for extraction, and final extraction of the herbicide residue is done with hexane. Hexane or petroleum ether are used for the extraction from carrots. Crushed samples from fish or fish fat are treated with sodium sulfate for extraction with alcohol. Samples containing amiben are treated with sulfuric acid, sodium chloride and ether and final extraction is done with benzene. The resulting purified samples are transferred in ether on chromatographic layers where propanide, solan, and dicryl are thermally decomposed at 160-170 C for one hour. Visualization is done by a chromogenic agent. Spraying is performed immediately after chromatographic determination without thermal decomposition for the detection of Amiben, 3,4-dichloroaniline, and 3-chloro-4-methylaniline. Ether-chloroform in a ratio of 1:1 as solvent system is used for propanide, solan, dicryl, 3,4-dichloroaniline, and 3-methyl-4-chloroaniline, and a 3:2 ratio of hexane-acetone is used for Amiben. The sensitivity for propanide, solan, and dicryl is 0.10-0.15 mg/kg cucumber or tomato, 0.2-0.3 mg/kg carrots, 0.50-0.75 mg/kg fish, and 0.25 mg Amiben per kg cabbage, tomato, or carrot.

73-1776. Sheynina, R. I.; Dzhiyanbayeva, R. Kh.; Khalimova, U. Kh.; Talipov, Sh. T.; Ibraimov, Ch. I. (V. I. Lenin Tashkent State Univ., Tashkent, USSR). **Opredeleniye mikrogrammovykh kolichestv fosfororganicheskogo soyedineniya butifosa kineticheskim metodom. [Determination of microgram amounts of an organophosphorus compound butyphos by a kinetic method.]** *Zh. Anal. Khim. 27(8): 1643-1647; 1972.* (11 references) (Russian)

A kinetic photometric method is described for the determination of butyphos (DEF) in cotton seed and fiber extracts and in cotton-seed oil. The method is based on the ability of butyphos to catalyze the oxidation of aromatic diamines – benzidine and *o*-dianisidine with hydrogen peroxide. The reaction rate was almost constant at the respective benzidine and *o*-dianisidine

concentrations exceeding 0.0011 *M* and 0.0014 *M*. The optimum hydrogen peroxide concentrations determined for benzidine and *o*-dianisidine are 0.050-0.095 *M* and 0.08-0.14 *M*. The lower limit of detection is 0.03 μg/ml for benzidine and 0.01 μg/ml for *o*-dianisidine. The rate of the catalytic reaction is highest at a pH value of 12.

See also **73-1547** **73-1573** **73-1575** **73-1654**

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